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NRCS

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 Webster 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 2006. Soil names and descriptions were approved in 2006. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2006. 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 Webster 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: Soybeans in an area of Nicollet loam, 1 to 3 percent slopes. Nicollet soils are very productive and are farmed intensively in Webster County.

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 2008

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 map unit 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
Webster 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

Webster County is in central Iowa (fig. 1). It has an area of 459,600 acres, or about 717 square miles. Fort Dodge is the county seat.

This survey updates the previous survey of Webster County published in 1975 (Koppen, 1975). 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 Area 103. 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). Webster County is a subset of MLRA 103. In some cases in this survey, a soil may be referred to that was not mapped specifically in Webster County but that does occur within MLRA 103.

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

Figure 1.—Location of Webster County in Iowa.

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

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

Soil scientists recorded the characteristics of the soil profiles that they 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 high 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 Webster County. It describes history and development, industry, transportation facilities, recreation, farming, physiography and drainage, and climate.

History and Development

Prior to 1850, only a few widely scattered farms were in Webster County. In 1850, a military post known as Fort Clarke was established on the high grounds east of the Des Moines River and south of Soldier Creek. These high grounds provided protection for the few settlers who lived in the area. The following year, Fort Clarke's name was changed to Fort Dodge. By 1853, the fort had been abandoned, but the settlement formed the nucleus for the city of Fort Dodge.

Webster County was officially organized on January 22, 1853. Fort Dodge was named the county seat in 1856.

By 1860, the population of the county had increased to 2,504. It was 31,775 in 1900. In 1967, Fort Dodge had a population of 29,654. In 2000, the population of Webster County was 40,235.

Industry

Farming is the dominant enterprise in Webster County, but several industries are located in the county, primarily in the Fort Dodge area. Among these industries are meat-packing facilities, gypsum manufacturing plants, livestock feed producers, and farm machinery manufacturers. Also, clay tile products are manufactured at several plants between Lehigh and the Fort Dodge area. In addition, a large limestone rock quarry in Fort Dodge furnishes limestone throughout the country. Other industrial plants include a large plant for manufacturing nitrogen fertilizer, located a few miles east of Fort Dodge, and a large laboratory that produces vaccines and serum for livestock.

Transportation Facilities

U.S. Highway 20 serves east-west traffic across the county, and U.S. Highway 169 serves north-south traffic. These two highways intersect in Fort Dodge and are connected with State Routes 7, 50, and 175. All farms in the county have access to hard-surfaced or graveled roads.

Other transportation facilities include railroads, airline service, bus lines, and motor freight lines. Three railroads serve the city of Fort Dodge, and most towns in the county are served by one or more railroads. Scheduled airline transportation is available in the north-central part of the county. Bus transportation is available on the main highways, and motor freight lines are served in every trading center.

Recreation

Many parks and recreational areas have been established throughout Webster County. Examples are John F. Kennedy Memorial Park, Badger Lake Recreational Area, Brushy Creek State Recreation Area, and Dolliver Memorial State Park.

John F. Kennedy Memorial Park is the largest park (395 acres) managed by the Webster County Conservation Board. The park was officially dedicated in 1965.

Badger Lake is a 45-acre manmade impoundment. It is stocked with largemouth bass, crappie, channel catfish, bluegill, and northern pike.

Brushy Creek State Recreation Area and Dolliver Memorial State Park offer camping, fishing, and hiking trails. Brushy Creek has a 690-acre lake and also has an equestrian park for camping and trail riding. Dolliver Park is also known for its "Copperas Beds," which are unique sandstone formations towering 100 feet above Prairie Creek.

Farming

In 2002, Webster County had 417,019 acres of farmland, according to the Iowa Department of Agriculture and Land Stewardship and Iowa State University. Corn, soybeans, oats, and hay accounted for 370,268 acres of the land used for agricultural production. The rest consisted of pastureland, forestland, or idle land.

In recent years, the number of farms in the county has decreased and the average size of farms has increased. According to a report published in 2002 by the Iowa Department of Agriculture and Land Stewardship and Iowa State University, the number of farms was 932 and the average farm size was 447 acres.

Corn and soybeans are the dominant row crops. Hay, oats, and pasture grasses also are grown. Livestock production is becoming more specialized as many farmers are raising only one class of livestock. In recent years, the number of total confinement livestock systems has increased. Most of the farmers using these systems raise primarily swine or poultry.

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

Physiography and Drainage

Most of the soils in Webster County are nearly level to moderately sloping. The greatest differences in relief are in the vicinity of the Des Moines River and near the mouth of tributary streams, where the slopes are steep in places. Generally, the elevation of the uplands ranges from 1,100 to 1,200 feet. The soil surface is somewhat higher in the western, northern, and extreme southern parts of the county. Small moraine hills of low relief extend across the county along the southern boundary and through the northern two-thirds of the county. The nearly level soils in the county, mainly in areas of the Marna-Guckeen-Brownton association (fig. 2), contain

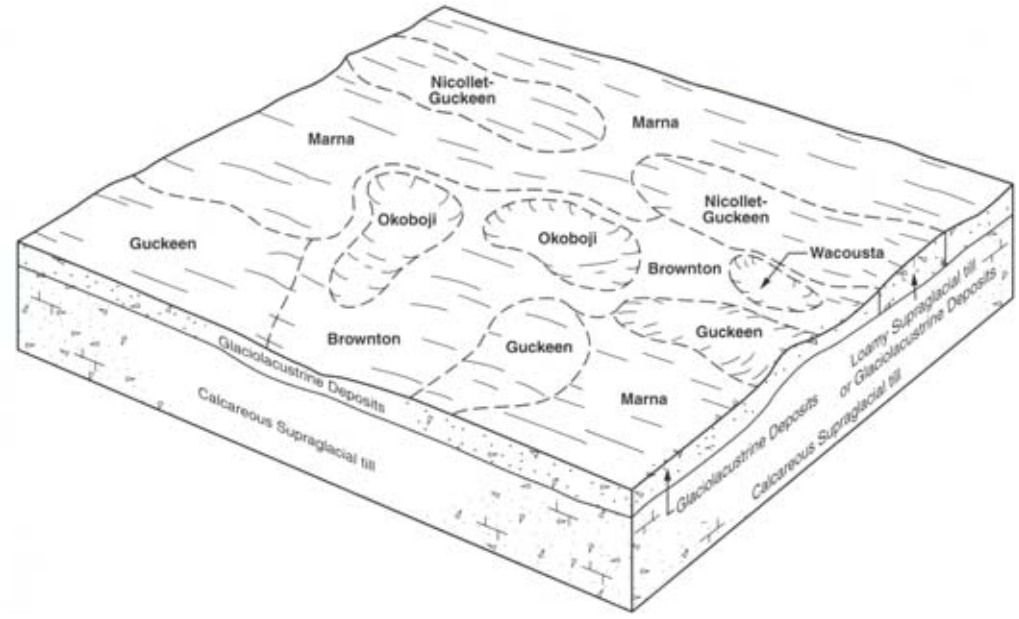

Figure 2.—Typical pattern of soils and parent material in the Marna-Guckeen-Brownton association, which is described under the heading "General Soil Map Units."

depressions that were once wet and swampy. Most of these areas have since been artificially drained and are now used as cropland.

In Webster County, the Des Moines River flows from about the center of the northern boundary to the eastward side of the southern boundary. In most places the valley of the Des Moines River is less than three-fourths of a mile wide, but it is deep. This river and its tributary streams, most of which are relatively short, provide the stream drainage for much of the county.

Among the streams that flow into the Des Moines River in Webster County are Deer, Bass, Badger, Soldier, Brushy, Skillet, Prairie, and Lizard Creeks. A few creeks in the southwestern part of the county, including the east and west branches of Buttrick Creek and Hardin Creek, drain into the Raccoon River. In the northeastern part of the county, a small area drains into the Boone River.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Fort Dodge, Iowa, in the period 1971 to 2000. 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 20 degrees F and the average daily minimum temperature is 11 degrees. The lowest temperature during the period of record was -30 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 83 degrees. The highest temperature during the period of record was 106 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 about 34.4 inches. Of this total, about 25 inches, or 73 percent, usually falls in April through September. The growing season for most crops falls within this period.

The average seasonal snowfall is 36 inches. On the average, 34 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

Table 1.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Fort Dodge, Iowa)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	25.9	7.1	16.5	53	-21	1	0.94	0.32	1.55	2	8.4
February---	32.4	13.5	22.9	61	-21	10	.82	.38	1.14	2	7.1
March------	45.1	25.0	35.1	77	-4	76	2.24	.88	3.58	4	5.7
April------	60.0	36.4	48.2	88	15	281	3.42	1.87	4.83	6	1.8
May--------	72.5	48.4	60.5	92	29	634	4.38	2.82	5.78	8	.0
June-------	81.7	58.3	70.0	98	42	899	5.12	3.11	6.88	8	.0
July-------	84.8	62.7	73.8	99	48	1,045	4.48	2.41	6.32	6	.0
August-----	82.2	60.2	71.2	97	45	965	4.35	1.79	6.86	5	.0
September--	75.4	50.7	63.1	94	30	689	3.27	1.47	4.72	5	.0
October----	62.5	38.9	50.7	87	19	348	2.37	1.13	3.63	4	.2
November---	44.1	25.6	34.9	71	0	68	1.92	.78	2.93	4	4.5
December---	29.9	12.6	21.3	58	-17	5	1.12	.59	1.61	3	8.3
Yearly:											
Average---	58.1	36.6	47.3	---	---	---	---	---	---	---	---
Extreme---	106	-30	---	101	-24	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,021	34.43	28.44	39.95	57	36.0

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

Table 2.--Freeze Dates in Spring and Fall

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

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 18	Apr. 30	May 16
2 years in 10 later than--	Apr. 14	Apr. 26	May 10
5 years in 10 later than--	Apr. 5	Apr. 18	Apr. 30
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 13	Sept. 25	Sept. 19
2 years in 10 earlier than--	Oct. 18	Oct. 1	Sept. 24
5 years in 10 earlier than--	Oct. 27	Oct. 12	Oct. 3

Table 3.--Growing Season

(Recorded in the period 1971-2000 at Fort Dodge, 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	187	159	138
8 years in 10	193	165	144
5 years in 10	204	177	156
2 years in 10	215	189	167
1 year in 10	220	195	173

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. Webster-Clarion-Nicollet Association (fig. 3)

Extent of the association in the survey area: 63 percent

Component Description

Webster
Extent: 30 percent of the association
Position on the landform: Flats and swales
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Till-derived sediments over supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 6.1 percent

Clarion
Extent: 21 percent of the association
Position on the landform: 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 supraglacial till
Flooding: None

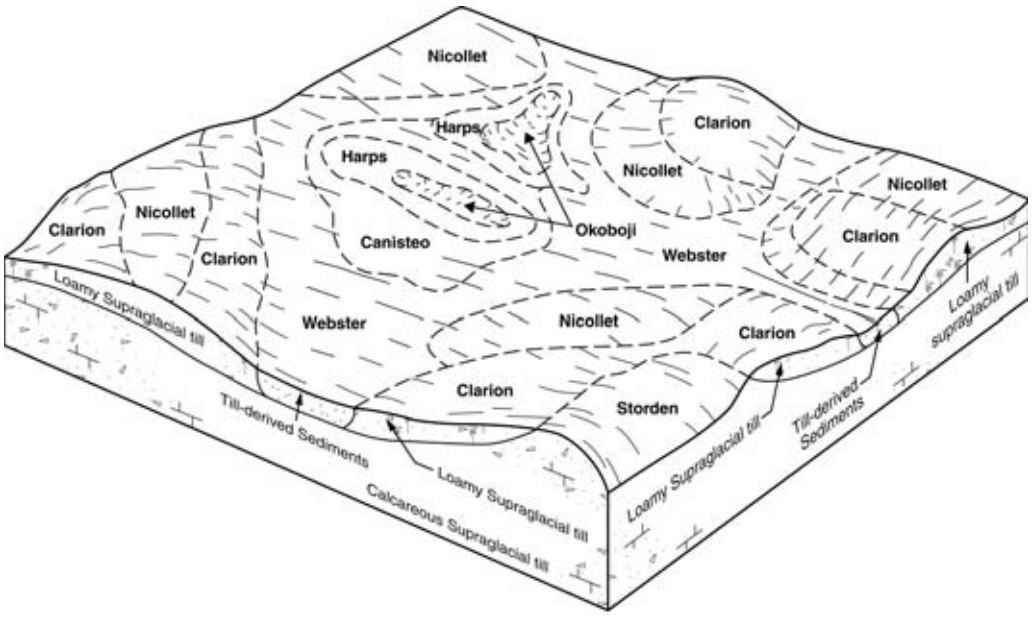

Figure 3.—Typical pattern of soils and parent material in the Webster-Clarion-Nicollet association.

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: 11.3 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Nicollet
Extent: 19 percent of the association
Position on the landform: Slightly convex rises
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Soils of Minor Extent

Canisteo
Extent: 0 to 30 percent of the association

Harps
Extent: 0 to 30 percent of the association

Okoboji
Extent: 0 to 30 percent of the association

2. Marna-Guckeen-Brownton Association

Extent of the association in the survey area: 22 percent

Component Description

Marna
Extent: 49 percent of the association
Position on the landform: Flats and swales
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: Glaciolacustrine deposits over supraglacial 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: 10.5 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Guckeen
Extent: 19 percent of the association
Position on the landform: Slight rises
Slope range: 1 to 3 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Glaciolacustrine deposits over supraglacial 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: 5.0 percent

Brownton
Extent: 16 percent of the association
Position on the landform: Flats and swales
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: Glaciolacustrine deposits over supraglacial 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: 10.5 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Soils of Minor Extent

Wacousta
Extent: 0 to 16 percent of the association

Clarion
Extent: 0 to 16 percent of the association

Okoboji
Extent: 0 to 16 percent of the association

3. Lester-Coland-Wadena Association (fig. 4)

Extent of the association in the survey area: 14 percent

Component Description

Lester
Extent: 32 percent of the association
Position on the landform: Side slopes
Slope range: 9 to 70 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.5 inches
Content of organic matter in the upper 10 inches: 3.1 percent

Coland
Extent: 21 percent of the association
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
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: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.2 inches
Content of organic matter in the upper 10 inches: 5.7 percent

Wadena
Extent: 11 percent of the association
Position on the landform: Treads and risers on stream terraces
Slope range: 0 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 sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 6.5 inches
Content of organic matter in the upper 10 inches: 3.3 percent

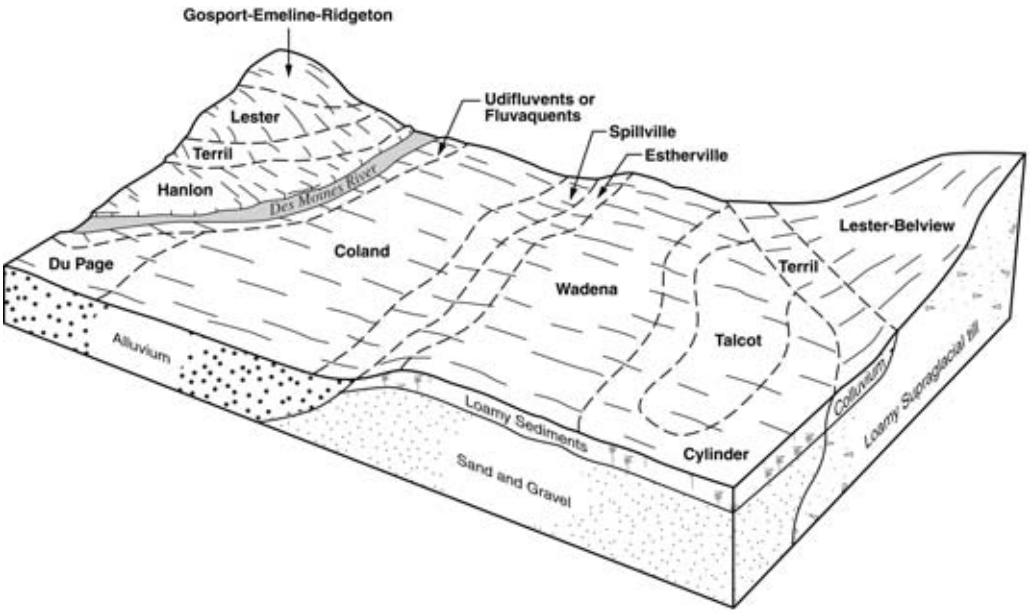

Figure 4.—Typical pattern of soils and parent material in the Lester-Coland-Wadena association.

Soils of Minor Extent

Gosport
Extent: 0 to 36 percent of the association

Hanlon
Extent: 0 to 36 percent of the association

Talcot
Extent: 0 to 36 percent of the association

Terril
Extent: 0 to 36 percent of the association

4. Clarion-Coland Association (fig. 5)

Extent of the association in the survey area: 1 percent

Component Description

Clarion
Extent: 44 percent of the association
Position on the landform: 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 supraglacial till
Flooding: None
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: 6.5 feet (August, September, October)
Ponding: None

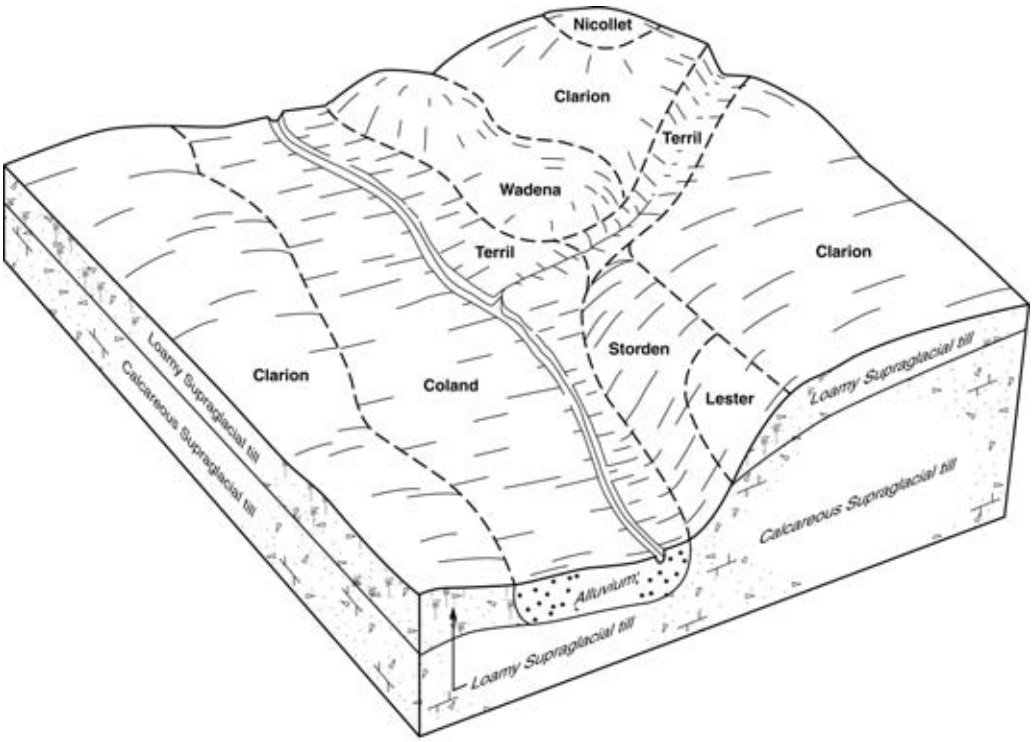

Figure 5.—Typical pattern of soils and parent material in the Clarion-Coland association.

Available water capacity to a depth of 60 inches: 11.3 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Coland
Extent: 39 percent of the association
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
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: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.2 inches
Content of organic matter in the upper 10 inches: 5.7 percent

Soils of Minor Extent

Storden
Extent: 0 to 17 percent of the association

Wadena
Extent: 0 to 17 percent of the association

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, Clarion loam, 5 to 9 percent slopes, moderately eroded, is a phase of the Clarion series.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. 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.

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

Component Description

Okoboji, depressional, ponded, and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium derived from supraglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 8.3 percent

Minor Dissimilar Components

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

Knoke, depressional, ponded, and similar soils
Extent: 5 to 10 percent of the unit

Okoboji mucky silty clay loam, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

27B—Terril loam, 1 to 5 percent slopes

Component Description

Terril and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Footslopes

Slope range: 1 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 alluvium and/or 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: 11.8 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

Spillville, rarely flooded, and similar soils
Extent: 5 to 15 percent of the unit

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

34—Estherville sandy loam, 0 to 2 percent slopes

Component Description

Estherville and similar soils
Extent: 85 to 95 percent of the unit
Position on the landform: Flats on outwash plains; treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 4.1 inches
Content of organic matter in the upper 10 inches: 1.6 percent

Minor Dissimilar Components

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

34B—Estherville sandy loam, 2 to 5 percent slopes

Component Description

Estherville and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Slight rises on outwash plains; risers on stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
Ponding: None

Available water capacity to a depth of 60 inches: 4.1 inches
Content of organic matter in the upper 10 inches: 1.6 percent

Minor Dissimilar Components

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

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

55—Nicollet loam, 1 to 3 percent slopes

Component Description

Nicollet and similar soils
Extent: 60 to 90 percent of the unit
Position on the landform: Slightly convex rises
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Minor Dissimilar Components

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

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

Rolfe, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

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

62F—Storden loam, 18 to 25 percent slopes

Component Description

Storden and similar soils
Extent: 65 to 90 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 25 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous supraglacial till
Flooding: None
Ponding: None

Available water capacity to a depth of 60 inches: 11.0 inches
Content of organic matter in the upper 10 inches: 2.4 percent

Minor Dissimilar Components

Sunburg, moderately eroded, and similar soils
Extent: 5 to 15 percent of the unit

Omsrud, moderately eroded, and similar soils
Extent: 5 to 10 percent of the unit

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

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

Component Description

Okoboji mucky silty clay loam, depressional, ponded, and similar soils
Extent: 80 to 90 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Mucky silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium derived from supraglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 13.7 percent

Minor Dissimilar Components

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

Knoke, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

Okoboji silty clay loam, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

95—Harps clay loam, 0 to 2 percent slopes

Component Description

Harps and similar soils
Extent: 70 to 95 percent of the unit
Position on the landform: Rims of depressions
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained

Parent material: Calcareous supraglacial 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: 11.1 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Canisteo and similar soils
Extent: 5 to 10 percent of the unit

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

Okoboji, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

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

Component Description

Webster and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Flats and swales
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Till-derived sediments over supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 6.1 percent

Minor Dissimilar Components

Canisteo and similar soils
Extent: 5 to 15 percent of the unit

Nicollet and similar soils
Extent: 5 to 10 percent of the unit

Okoboji, depressional, ponded, and similar soils
Extent: 0 to 5 percent of the unit

108—Wadena loam, 0 to 2 percent slopes

Component Description

Wadena and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Flats on outwash plains; 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 sediments over sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 6.5 inches
Content of organic matter in the upper 10 inches: 3.3 percent

Minor Dissimilar Components

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

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

108B—Wadena loam, 2 to 5 percent slopes

Component Description

Wadena and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Slight rises on outwash plains; 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 sediments over sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 5.7 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Minor Dissimilar Components

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

108C—Wadena loam, 5 to 9 percent slopes

Component Description

Wadena and similar soils
Extent: 65 to 85 percent of the unit
Position on the landform: Side slopes on outwash plains; risers on stream terraces
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 sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 5.7 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Minor Dissimilar Components

Fort Dodge and similar soils
Extent: 5 to 15 percent of the unit

Kanaranzi and similar soils
Extent: 5 to 15 percent of the unit

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

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

Component Description

Coland, occasionally flooded, and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
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: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.2 inches
Content of organic matter in the upper 10 inches: 5.7 percent

Minor Dissimilar Components

Spillville, occasionally flooded, and similar soils
Extent: 5 to 15 percent of the unit

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

136—Ankeny fine sandy loam, 0 to 2 percent slopes, rarely flooded

Component Description

Ankeny, rarely flooded, and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Sandy 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)
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

Dickinson and similar soils
Extent: 5 to 10 percent of the unit

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

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

138B—Clarion loam, 2 to 5 percent slopes

Component Description

Clarion and similar soils
Extent: 60 to 95 percent of the unit
Position on the landform: Shoulders and side slopes
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 supraglacial till
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: 11.3 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Minor Dissimilar Components

Nicollet and similar soils
Extent: 5 to 15 percent of the unit

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

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

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

Component Description

Clarion, moderately eroded, and similar soils
Extent: 65 to 90 percent of the unit
Position on the landform: Side slopes and shoulders
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 supraglacial till
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: 11.8 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

Clarion, slightly eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

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

201B—Coland-Terril complex, 1 to 5 percent slopes

Component Description

Coland and similar soils
Extent: 45 to 55 percent of the unit
Position on the landform: Upland drainageways
Slope range: 1 to 5 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
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: 11.2 inches
Content of organic matter in the upper 10 inches: 5.7 percent

Terril and similar soils
Extent: 30 to 40 percent of the unit
Position on the landform: Footslopes along upland drainageways
Slope range: 1 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 alluvium and/or 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: 11.8 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

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

Coland, frequently flooded, and similar soils
Extent: 0 to 10 percent of the unit

203—Cylinder loam, 0 to 2 percent slopes

Component Description

Cylinder and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Flats on outwash plains; 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: Somewhat poorly drained
Parent material: Loamy sediments over sand and gravel
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: 6.5 inches
Content of organic matter in the upper 10 inches: 4.1 percent

Minor Dissimilar Components

Biscay and similar soils
Extent: 5 to 15 percent of the unit

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

227—Wadena loam, loamy substratum, 0 to 2 percent slopes

Component Description

Wadena, loamy substratum, and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Flats and 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: Well drained
Parent material: Loamy sediments over sand and gravel over supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 6.6 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Minor Dissimilar Components

Round Lake and similar soils
Extent: 10 to 20 percent of the unit

Wadena and similar soils
Extent: 10 to 20 percent of the unit

227B—Wadena loam, loamy substratum, 2 to 5 percent slopes

Component Description

Wadena, loamy substratum, and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Shoulders and side slopes
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over sand and gravel over supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 6.6 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Minor Dissimilar Components

Round Lake and similar soils
Extent: 10 to 20 percent of the unit

Wadena and similar soils
Extent: 10 to 20 percent of the unit

228—Cylinder loam, loamy substratum, 0 to 2 percent slopes

Component Description

Cylinder, loamy substratum, and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Summits and flats
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over sand and gravel over supraglacial 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: 7.5 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Minor Dissimilar Components

Cylinder and similar soils
Extent: 10 to 20 percent of the unit

Biscay and similar soils
Extent: 5 to 15 percent of the unit

Biscay, loamy substratum, and similar soils
Extent: 0 to 10 percent of the unit

236D—Lester loam, 9 to 14 percent slopes

Component Description

Lester and similar soils
Extent: 60 to 90 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 supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.5 inches
Content of organic matter in the upper 10 inches: 3.1 percent

Minor Dissimilar Components

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

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

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

236E—Lester loam, 14 to 18 percent slopes

Component Description

Lester and similar soils
Extent: 65 to 90 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 supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.5 inches
Content of organic matter in the upper 10 inches: 3.1 percent

Minor Dissimilar Components

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

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

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

236F—Lester loam, 18 to 25 percent slopes

Component Description

Lester and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 25 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.5 inches
Content of organic matter in the upper 10 inches: 3.1 percent

Minor Dissimilar Components

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

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

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

259—Biscay clay loam, 0 to 2 percent slopes

Component Description

Biscay and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Flats on outwash plains; treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
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: 7.7 inches
Content of organic matter in the upper 10 inches: 5.4 percent

Minor Dissimilar Components

Cylinder and similar soils
Extent: 5 to 15 percent of the unit

Biscay, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

262G—Lester-Belview complex, 25 to 70 percent slopes

Component Description

Lester and similar soils
Extent: 45 to 65 percent of the unit
Position on the landform: Side slopes
Slope range: 25 to 70 percent (fig. 6)
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.5 inches
Content of organic matter in the upper 10 inches: 3.1 percent

Belview and similar soils
Extent: 15 to 25 percent of the unit
Position on the landform: Side slopes
Slope range: 25 to 70 percent (fig. 6)
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loamy supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.6 inches
Content of organic matter in the upper 10 inches: 3.7 percent

Minor Dissimilar Components

Ridgeton and similar soils
Extent: 5 to 15 percent of the unit

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

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

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

Component Description

Rolfe, depressional, ponded, and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Till-derived sediments and supraglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)

Figure 6.—An area of Lester-Belview complex, 25 to 70 percent slopes. Crop production is not practical in areas of these soils, which are subject to erosion.

Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 9.6 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Webster and similar soils
Extent: 5 to 15 percent of the unit

Okoboji, depressional, ponded, and similar soils
Extent: 0 to 15 percent of the unit

278—Biscay clay loam, loamy substratum, 0 to 2 percent slopes

Component Description

Biscay, loamy substratum, and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Upland flats
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy sediments over sand and gravel over supraglacial 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: 7.4 inches
Content of organic matter in the upper 10 inches: 5.7 percent

Minor Dissimilar Components

Biscay and similar soils
Extent: 10 to 20 percent of the unit

Biscay, depressional, ponded, and similar soils
Extent: 5 to 15 percent of the unit

Cylinder, loamy substratum, and similar soils
Extent: 0 to 10 percent of the unit

307—Dundas silt loam, 0 to 2 percent slopes

Component Description

Dundas and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Flats and swales
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: Poorly drained
Parent material: Supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Minor Dissimilar Components

Luther and similar soils
Extent: 5 to 15 percent of the unit

Minnetonka and similar soils
Extent: 5 to 15 percent of the unit

315B—Udifluvents, loamy, 2 to 5 percent slopes, occasionally flooded

Component Description

Udifluvents, occasionally flooded, and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Flood plains
Slope range: 2 to 5 percent
Texture of the surface layer: Variable
Depth to restrictive feature: Very deep (more than 60 inches)
Parent material: Sandy alluvium and/or loamy 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)
Ponding: None

Minor Dissimilar Components

Fluvaquents, frequently flooded, and similar soils
Extent: 5 to 15 percent of the unit

Udifluvents, sandy, occasionally flooded, and similar soils
Extent: 5 to 15 percent of the unit

323B—Fort Dodge loam, 2 to 5 percent slopes

Component Description

Fort Dodge and similar soils
Extent: 85 to 95 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: Well drained
Parent material: Loamy alluvium and/or loamy colluvium
Flooding: None
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

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

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

325—Le Sueur loam, 1 to 3 percent slopes

Component Description

Le Sueur and similar soils
Extent: 85 to 95 percent of the unit
Position on the landform: Summits and slight rises

Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy supraglacial 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: 12.0 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Minor Dissimilar Components

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

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

338—Garmore loam, 0 to 2 percent slopes

Component Description

Garmore and similar soils
Extent: 100 percent of the unit
Position on the landform: Flats
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Supraglacial till
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: 10.8 inches
Content of organic matter in the upper 10 inches: 3.8 percent

342—Estherville sandy loam, loamy substratum, 0 to 2 percent slopes

Component Description

Estherville, loamy substratum, and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Summits and flats
Slope range: 0 to 2 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Loamy sediments over sand and gravel over supraglacial till
Flooding: None
Ponding: None

Available water capacity to a depth of 60 inches: 3.7 inches
Content of organic matter in the upper 10 inches: 1.6 percent

Minor Dissimilar Components

Estherville and similar soils
Extent: 10 to 20 percent of the unit

Round Lake and similar soils
Extent: 10 to 20 percent of the unit

342B—Estherville sandy loam, loamy substratum, 2 to 5 percent slopes

Component Description

Estherville, loamy substratum, and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Summits and side slopes
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Loamy sediments over sand and gravel over supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 3.7 inches
Content of organic matter in the upper 10 inches: 1.6 percent

Minor Dissimilar Components

Estherville and similar soils
Extent: 10 to 20 percent of the unit

Round Lake and similar soils
Extent: 10 to 20 percent of the unit

344B—Copaston loam, 2 to 5 percent slopes

Component Description

Copaston and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Risers on structural benches
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Parent material: Loamy supraglacial till over limestone bedrock
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 2.9 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Minor Dissimilar Components

Emeline and similar soils
Extent: 5 to 15 percent of the unit

Rockton, 30 to 40 inches to bedrock, and similar soils
Extent: 5 to 15 percent of the unit

345—Copaston-Jacwin complex, 1 to 3 percent slopes

Component Description

Copaston and similar soils
Extent: 30 to 40 percent of the unit
Position on the landform: Treads on structural benches
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Parent material: Loamy supraglacial till over limestone bedrock
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 2.9 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Jacwin and similar soils
Extent: 20 to 30 percent of the unit
Position on the landform: Treads on structural benches
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 30 to 50 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over shale
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: 6.4 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Faxon and similar soils
Extent: 10 to 20 percent of the unit

Terril and similar soils
Extent: 10 to 20 percent of the unit

Atkinson and similar soils
Extent: 5 to 15 percent of the unit

355—Luther loam, 1 to 3 percent slopes

Component Description

Luther and similar soils
Extent: 80 to 90 percent of the unit
Position on the landform: Slight rises
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: Loamy supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Minor Dissimilar Components

Angus and similar soils
Extent: 5 to 15 percent of the unit

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

383—Marna silty clay loam, 0 to 2 percent slopes

Component Description

Marna and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Swales and flats
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: Glaciolacustrine deposits over supraglacial 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: 10.5 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

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

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

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

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

385—Guckeen silty clay loam, 1 to 3 percent slopes

Component Description

Guckeen and similar soils
Extent: 70 to 80 percent of the unit
Position on the landform: Slight rises
Slope range: 1 to 3 percent
Texture of the surface layer: Silty clay loam

Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Glaciolacustrine deposits over supraglacial 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: 5.0 percent

Minor Dissimilar Components

Kamrar and similar soils
Extent: 5 to 15 percent of the unit

Marna and similar soils
Extent: 5 to 15 percent of the unit

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

386—Cordova clay loam, 0 to 2 percent slopes

Component Description

Cordova and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Flats and swales
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Supraglacial 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: 10.7 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Minor Dissimilar Components

Le Sueur and similar soils
Extent: 5 to 15 percent of the unit

Okoboji, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

387B—Kamrar silty clay loam, 2 to 5 percent slopes

Component Description

Kamrar and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Summits and shoulders
Slope range: 2 to 5 percent
Texture of the surface layer: Silty clay loam

Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Lacustrine sediments over loamy supraglacial 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: 10.2 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Guckeen and similar soils
Extent: 5 to 15 percent of the unit

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

413G—Gosport-Emeline-Ridgeton complex, 25 to 75 percent slopes

Component Description

Gosport and similar soils
Extent: 20 to 75 percent of the unit
Position on the landform: Side slopes and escarpments
Slope range: 25 to 60 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Parent material: Residuum derived from shale
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: 3.7 inches
Content of organic matter in the upper 10 inches: 2.6 percent

Emeline and similar soils
Extent: 20 to 75 percent of the unit
Position on the landform: Side slopes and escarpments
Slope range: 25 to 75 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 4 to 12 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Parent material: Loamy sediments over limestone bedrock
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 1.8 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Ridgeton and similar soils
Extent: 20 to 75 percent of the unit
Position on the landform: Footslopes of escarpments

Slope range: 25 to 40 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy colluvium over supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Minor Dissimilar Components

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

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

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

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

457—Du Page silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Du Page, occasionally flooded, and similar soils
Extent: 75 to 95 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: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 11.1 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Lawson, frequently flooded, and similar soils
Extent: 5 to 15 percent of the unit

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

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

Component Description

Spillville, occasionally flooded, and similar soils
Extent: 60 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, December
Highest frequency of flooding: Occasional (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

Coland, occasionally flooded, and similar soils
Extent: 5 to 15 percent of the unit

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

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

485B—Spillville loam, 2 to 5 percent slopes, rarely flooded

Component Description

Spillville, rarely flooded, and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Flood plains
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 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: 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: 11.8 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Minor Dissimilar Components

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

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

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

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

Component Description

Wacousta, depressional, ponded, and similar soils
Extent: 70 to 95 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium derived from supraglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 8.9 percent

Minor Dissimilar Components

Calcousta, depressional, ponded, and similar soils
Extent: 5 to 10 percent of the unit

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

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

507—Canisteo clay loam, 0 to 2 percent slopes

Component Description

Canisteo and similar soils
Extent: 55 to 90 percent of the unit
Position on the landform: Flats and swales
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained

Parent material: Till-derived sediments over supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 6.5 percent

Minor Dissimilar Components

Webster and similar soils
Extent: 5 to 15 percent of the unit

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

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

Okoboji, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

511—Blue Earth mucky silt loam, depressional, 0 to 1 percent slopes

Component Description

Blue Earth, depressional, ponded, and similar soils
Extent: 80 to 90 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Mucky silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Coprogenic material over supraglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 17.5 percent

Minor Dissimilar Components

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

Okoboji mucky silty clay loam, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

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

Component Description

Wacousta, mucky, depressional, ponded, and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Mucky silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium derived from supraglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 12.4 inches
Content of organic matter in the upper 10 inches: 13.0 percent

Minor Dissimilar Components

Calcousta, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

Okoboji mucky silty clay loam, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

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

Component Description

Hanlon, occasionally flooded, and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Alluvium
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: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 9.7 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

Ankeny, rarely flooded, and similar soils
Extent: 5 to 15 percent of the unit

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

541C—Estherville-Hawick complex, 5 to 9 percent slopes

Component Description

Estherville and similar soils
Extent: 25 to 65 percent of the unit
Position on the landform: Side slopes on outwash plains; risers on stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 4.1 inches
Content of organic matter in the upper 10 inches: 1.6 percent

Hawick and similar soils
Extent: 25 to 65 percent of the unit
Position on the landform: Side slopes on outwash plains; risers on stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Coarse sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 3.2 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Minor Dissimilar Components

Fort Dodge and similar soils
Extent: 5 to 15 percent of the unit

551B—Calamine silty clay loam, 2 to 5 percent slopes

Component Description

Calamine and similar soils
Extent: 80 to 90 percent of the unit
Position on the landform: Risers on structural benches
Slope range: 2 to 5 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: Silty deposits over 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

Minor Dissimilar Components

Cosmos, bouldery, and similar soils
Extent: 0 to 10 percent of the unit

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

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

551D—Calamine silty clay loam, 5 to 14 percent slopes

Component Description

Calamine and similar soils
Extent: 45 to 65 percent of the unit
Position on the landform: Risers on structural benches
Slope range: 5 to 14 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: Silty deposits over 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

Minor Dissimilar Components

Lester and similar soils
Extent: 10 to 30 percent of the unit

Moingona and similar soils
Extent: 10 to 30 percent of the unit

Cosmos, bouldery, and similar soils
Extent: 0 to 10 percent of the unit

559—Talcot clay loam, 0 to 2 percent slopes

Component Description

Talcot and similar soils
Extent: 80 to 90 percent of the unit
Position on the landform: Flats on outwash plains; treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy sediments over sand and gravel

Flooding: None
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: 6.8 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Biscay, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

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

561—Talcot clay loam, loamy substratum, 0 to 2 percent slopes

Component Description

Talcot, loamy substratum, and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Flats
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy sediments over sand and gravel over supraglacial 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: 7.9 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Talcot and similar soils
Extent: 15 to 25 percent of the unit

Biscay, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

Cylinder, loamy substratum, and similar soils
Extent: 0 to 10 percent of the unit

566C—Moingona loam, 5 to 9 percent slopes

Component Description

Moingona and similar soils
Extent: 85 to 95 percent of the unit
Position on the landform: Footslopes
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 alluvium and/or 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: 10.8 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

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

568D—Cokato loam, 9 to 14 percent slopes

Component Description

Cokato 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: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.6 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Lester and similar soils
Extent: 5 to 15 percent of the unit

Ridgeton and similar soils
Extent: 5 to 15 percent of the unit

568E—Cokato loam, 14 to 18 percent slopes

Component Description

Cokato and similar soils
Extent: 70 to 90 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 supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.6 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Lester and similar soils
Extent: 5 to 15 percent of the unit

Ridgeton and similar soils
Extent: 5 to 15 percent of the unit

583—Minnetonka silty clay loam, 0 to 2 percent slopes

Component Description

Minnetonka and similar soils
Extent: 85 to 95 percent of the unit
Position on the landform: Flats and swales
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: Glaciolacustrine deposits
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: 10.8 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Shorewood and similar soils
Extent: 5 to 15 percent of the unit

606—Lanyon silty clay loam, depressional, 0 to 1 percent slopes

Component Description

Lanyon, depressional, ponded, and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Glaciolacustrine deposits
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 8.1 inches
Content of organic matter in the upper 10 inches: 6.5 percent

Minor Dissimilar Components

Brownton and similar soils
Extent: 5 to 15 percent of the unit

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

625—Lerdal silt loam, 1 to 3 percent slopes

Component Description

Lerdal and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Shoulders and slight rises
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: Supraglacial 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: 2.4 percent

Minor Dissimilar Components

Minnetonka and similar soils
Extent: 5 to 20 percent of the unit

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

636—Buckney fine sandy loam, 0 to 2 percent slopes, rarely flooded

Component Description

Buckney, rarely flooded, and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Flats on outwash plains; treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Fine sandy loam
Drainage class: Somewhat excessively drained
Parent material: 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)
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

Ankeny, rarely flooded, and similar soils
Extent: 5 to 15 percent of the unit

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

636B—Buckney fine sandy loam, 2 to 5 percent slopes, rarely flooded

Component Description

Buckney, rarely flooded, and similar soils
Extent: 85 to 95 percent of the unit
Position on the landform: Slight rises on outwash plains; risers on stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Fine sandy loam
Drainage class: Somewhat excessively drained
Parent material: 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)
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

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

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

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

Component Description

Clarion, moderately eroded, and similar soils
Extent: 40 to 60 percent of the unit
Position on the landform: Side slopes and shoulders
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 supraglacial till
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: 11.8 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Storden, moderately eroded, and similar soils
Extent: 30 to 40 percent of the unit
Position on the landform: Side slopes and shoulders
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Clarion, slightly eroded, and similar soils
Extent: 0 to 10 percent of the unit

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

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

650—Joliet-Faxon complex, 0 to 2 percent slopes

Component Description

Joliet and similar soils
Extent: 40 to 60 percent of the unit
Position on the landform: Treads on structural benches
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Poorly drained
Parent material: Loamy sediments over limestone
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: 3.7 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Faxon and similar soils
Extent: 40 to 50 percent of the unit
Position on the landform: Treads on structural benches
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Poorly drained
Parent material: Loamy alluvium over limestone
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: 6.3 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Rock outcrop
Extent: 0 to 10 percent of the unit

Romeo, frequently flooded, ponded, and similar soils
Extent: 0 to 10 percent of the unit

715—Fluvaquents, loamy, 0 to 2 percent slopes, frequently flooded

Component Description

Fluvaquents, loamy, frequently flooded, and similar soils
Extent: 55 to 75 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Variable
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Sandy alluvium and/or 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: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None

Minor Dissimilar Components

Psamments and similar soils
Extent: 10 to 20 percent of the unit

Fluvaquents, sandy, frequently flooded, and similar soils
Extent: 5 to 15 percent of the unit

Udifluvents, occasionally flooded, and similar soils
Extent: 5 to 15 percent of the unit

735—Havelock clay loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Havelock, occasionally flooded, and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Calcareous loamy 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: 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

Coland, occasionally flooded, and similar soils
Extent: 5 to 15 percent of the unit

Spillville, occasionally flooded, and similar soils
Extent: 5 to 15 percent of the unit

740D—Hawick coarse sandy loam, 9 to 14 percent slopes

Component Description

Hawick and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes on outwash plains; risers on stream terraces
Slope range: 9 to 14 percent
Texture of the surface layer: Coarse sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 3.2 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Minor Dissimilar Components

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

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

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

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

Component Description

Billett and similar soils
Extent: 85 to 95 percent of the unit
Position on the landform: Risers on 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 sandy alluvium

Flooding: None
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

Malardi and similar soils
Extent: 5 to 15 percent of the unit

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

Component Description

Billett and similar soils
Extent: 80 to 90 percent of the unit
Position on the landform: Risers on stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy alluvium and/or sandy alluvium
Flooding: None
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

Malardi and similar soils
Extent: 5 to 15 percent of the unit

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

777B—Wapsie loam, 2 to 5 percent slopes

Component Description

Wapsie and similar soils
Extent: 80 to 90 percent of the unit
Position on the landform: Slight rises on outwash plains; 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
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 6.3 inches
Content of organic matter in the upper 10 inches: 2.9 percent

Minor Dissimilar Components

Sattre and similar soils
Extent: 10 to 20 percent of the unit

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

Component Description

Storden, moderately eroded, and similar soils
Extent: 40 to 60 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: Calcareous supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Omsrud, moderately eroded, and similar soils
Extent: 30 to 40 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: Supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 2.3 percent

Minor Dissimilar Components

Sunburg, moderately eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

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

Component Description

Storden, moderately eroded, and similar soils
Extent: 40 to 60 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: Calcareous supraglacial till
Flooding: None
Ponding: None

Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Omsrud, moderately eroded, and similar soils
Extent: 30 to 40 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: Supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 2.3 percent

Minor Dissimilar Components

Sunburg, moderately eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

836B—Kilkenny silt loam, 2 to 5 percent slopes

Component Description

Kilkenny and similar soils
Extent: 55 to 75 percent of the unit
Position on the landform: Shoulders
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: Lacustrine deposits over supraglacial till
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: 10.4 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Minor Dissimilar Components

Shorewood and similar soils
Extent: 20 to 30 percent of the unit

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

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

854D—Fens, Aquolls, 5 to 14 percent slopes

Component Description

Fens, Aquolls, and similar soils
Extent: 70 to 95 percent of the unit
Position on the landform: Toeslopes and side slopes
Slope range: 5 to 14 percent
Texture of the surface layer: Muck
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Organic material
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: 18.5 inches
Content of organic matter in the upper 10 inches: 65.0 percent

Minor Dissimilar Components

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

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

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

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

855—Shorewood silty clay loam, 1 to 3 percent slopes

Component Description

Shorewood and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Slight rises
Slope range: 1 to 3 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Glaciolacustrine deposits over supraglacial 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: 10.2 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Kilkenny and similar soils
Extent: 5 to 15 percent of the unit

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

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

Component Description

Harps and similar soils
Extent: 40 to 50 percent of the unit
Position on the landform: Rims of depressions
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Calcareous supraglacial 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: 11.1 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Okoboji, depressional, ponded, and similar soils
Extent: 30 to 40 percent of the unit
Position on the landform: Depressions
Slope range: 0 to 1 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium derived from supraglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 8.3 percent

Minor Dissimilar Components

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

Knoke, depressional, ponded, and similar soils
Extent: 5 to 15 percent of the unit

1007—Cosmos clay loam, 0 to 3 percent slopes, bouldery

Component Description

Cosmos, bouldery, and similar soils
Extent: 50 to 80 percent of the unit
Position on the landform: Treads on high stream terraces
Slope range: 0 to 3 percent

Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Firm basal 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: 9.6 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Cosmos soils that are not bouldery
Extent: 5 to 20 percent of the unit

Kandiyohi, bouldery, and similar soils
Extent: 5 to 20 percent of the unit

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

Coland, occasionally flooded, and similar soils
Extent: 0 to 5 percent of the unit

Moingona and similar soils
Extent: 0 to 5 percent of the unit

Le Sueur and similar soils
Extent: 0 to 5 percent of the unit

Wadena and similar soils
Extent: 0 to 5 percent of the unit

1055B—Kandiyohi clay loam, 2 to 5 percent slopes, bouldery

Component Description

Kandiyohi, bouldery, and similar soils
Extent: 50 to 80 percent of the unit
Position on the landform: Treads on high stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Firm basal 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: 10.0 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Minor Dissimilar Components

Cosmos, bouldery, and similar soils
Extent: 5 to 20 percent of the unit

Cosmos and similar soils
Extent: 5 to 20 percent of the unit

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

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

Angus, moderately eroded, and similar soils
Extent: 0 to 5 percent of the unit

Spillville, rarely flooded, and similar soils
Extent: 0 to 5 percent of the unit

Wadena and similar soils
Extent: 0 to 2 percent of the unit

1138B—Clarion clay loam, 2 to 5 percent slopes

Component Description

Clarion and similar soils
Extent: 50 to 70 percent of the unit
Position on the landform: Side slopes and shoulders
Slope range: 2 to 5 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy supraglacial till
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: 11.3 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Minor Dissimilar Components

Guckeen and similar soils
Extent: 10 to 20 percent of the unit

Kamrar and similar soils
Extent: 10 to 20 percent of the unit

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

1236B—Angus loam, 2 to 5 percent slopes

Component Description

Angus and similar soils
Extent: 75 to 95 percent of the unit
Position on the landform: Shoulders and side slopes
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: Supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Le Sueur and similar soils
Extent: 5 to 15 percent of the unit

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

1236C—Angus loam, 5 to 9 percent slopes

Component Description

Angus and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Shoulders and 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: Supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

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

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

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

1259—Biscay clay loam, depressional, 0 to 1 percent slopes

Component Description

Biscay, depressional, ponded, and similar soils
Extent: 70 to 95 percent of the unit
Position on the landform: Depressions on outwash plains; depressions on stream terraces
Slope range: 0 to 1 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Loamy sediments over sand and gravel
Flooding: None

Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)
Available water capacity to a depth of 60 inches: 7.7 inches
Content of organic matter in the upper 10 inches: 5.4 percent

Minor Dissimilar Components

Shandep, depressional, ponded, and similar soils
Extent: 5 to 15 percent of the unit

Talcot and similar soils
Extent: 5 to 10 percent of the unit

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

1507—Brownton silty clay loam, 0 to 2 percent slopes

Component Description

Brownton and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Flats and swales
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: Glaciolacustrine deposits over supraglacial 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: 10.5 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Marna and similar soils
Extent: 5 to 15 percent of the unit

Lanyon, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

Okoboji, depressional, ponded, and similar soils
Extent: 0 to 10 percent of the unit

1555—Nicollet-Guckeen complex, 1 to 3 percent slopes

Component Description

Nicollet and similar soils
Extent: 35 to 45 percent of the unit
Position on the landform: Slight rises
Slope range: 1 to 3 percent
Texture of the surface layer: Loam

Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Guckeen and similar soils
Extent: 20 to 30 percent of the unit
Position on the landform: Slight rises
Slope range: 1 to 3 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Glaciolacustrine deposits over supraglacial 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: 5.0 percent

Minor Dissimilar Components

Marna and similar soils
Extent: 10 to 20 percent of the unit

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

Kamrar and similar soils
Extent: 5 to 15 percent of the unit

1836B—Kilkenny-Shorewood complex, 2 to 5 percent slopes

Component Description

Kilkenny and similar soils
Extent: 50 to 80 percent of the unit
Position on the landform: Shoulders
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: Lacustrine deposits over supraglacial till
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: 10.4 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Shorewood and similar soils
Extent: 20 to 30 percent of the unit
Position on the landform: Shoulders
Slope range: 2 to 5 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Glaciolacustrine deposits over supraglacial 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: 10.2 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

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

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

2700C—Ridgeton loam, 5 to 9 percent slopes

Component Description

Ridgeton and similar soils
Extent: 65 to 85 percent of the unit
Position on the landform: Footslopes
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 colluvium over supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Minor Dissimilar Components

Omsrud, moderately eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

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

2700D—Ridgeton loam, 9 to 14 percent slopes

Component Description

Ridgeton and similar soils
Extent: 65 to 90 percent of the unit
Position on the landform: Footslopes

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 colluvium over supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Minor Dissimilar Components

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

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

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

4000—Urban land

Component Description

Urban land
Extent: 100 percent of the unit
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4055—Nicollet-Urban land complex, 1 to 3 percent slopes

Component Description

Nicollet and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Slight rises
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Urban land
Extent: 25 to 75 percent of the unit
Slope range: 1 to 3 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4107—Webster-Urban land complex, 0 to 2 percent slopes

Component Description

Webster and similar soils
Extent: 55 to 65 percent of the unit
Position on the landform: Flats and swales
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Till-derived sediments over supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 6.1 percent

Urban land
Extent: 35 to 45 percent of the unit
Slope range: 0 to 2 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

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

Component Description

Clarion and similar soils
Extent: 40 to 60 percent of the unit
Position on the landform: Shoulders and side slopes
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 supraglacial till
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: 11.3 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Urban land
Extent: 25 to 35 percent of the unit
Slope range: 2 to 5 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

Minor Dissimilar Components

Udorthents and similar soils
Extent: 15 to 25 percent of the unit

4235B—Angus-Urban land complex, 2 to 5 percent slopes

Component Description

Angus and similar soils
Extent: 55 to 65 percent of the unit
Position on the landform: Shoulders
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: Supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Urban land
Extent: 35 to 45 percent of the unit
Slope range: 2 to 5 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4236D—Lester-Urban land complex, 9 to 14 percent slopes

Component Description

Lester and similar soils
Extent: 25 to 75 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 supraglacial till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 10.5 inches
Content of organic matter in the upper 10 inches: 3.1 percent

Urban land
Extent: 25 to 75 percent of the unit
Slope range: 9 to 14 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4325—Le Sueur-Urban land complex, 1 to 3 percent slopes

Component Description

Le Sueur and similar soils
Extent: 55 to 65 percent of the unit
Position on the landform: Slight rises
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy supraglacial 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: 12.0 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Urban land
Extent: 35 to 45 percent of the unit
Slope range: 1 to 3 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4444—Jacwin-Urban land complex, 1 to 3 percent slopes

Component Description

Jacwin and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Treads on structural benches
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 30 to 50 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over shale
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: 6.4 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Urban land
Extent: 25 to 75 percent of the unit
Slope range: 1 to 3 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

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

Component Description

Canisteo and similar soils
Extent: 45 to 55 percent of the unit
Position on the landform: Flats and swales
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Till-derived sediments over supraglacial 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: 10.9 inches
Content of organic matter in the upper 10 inches: 6.5 percent

Urban land
Extent: 45 to 55 percent of the unit
Slope range: 0 to 2 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4551B—Calamine-Urban land complex, 2 to 5 percent slopes

Component Description

Calamine and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Risers on structural benches
Slope range: 2 to 5 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: Silty deposits over 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

Urban land
Extent: 25 to 75 percent of the unit
Slope range: 2 to 5 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4551D—Calamine-Urban land complex, 5 to 14 percent slopes

Component Description

Calamine and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Risers on structural benches
Slope range: 5 to 14 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: Silty deposits over 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

Urban land
Extent: 25 to 75 percent of the unit
Slope range: 5 to 14 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4635—Buckney-Urban land complex, 0 to 2 percent slopes

Component Description

Buckney and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Alluvium
Flooding: None
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

Urban land
Extent: 25 to 75 percent of the unit
Slope range: 0 to 2 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4635B—Buckney-Urban land complex, 2 to 5 percent slopes

Component Description

Buckney and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Risers on 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: Somewhat excessively drained
Parent material: Alluvium
Flooding: None
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

Urban land
Extent: 25 to 75 percent of the unit
Slope range: 2 to 5 percent
General description: Urban land consists mainly of residential areas and is covered by impervious surfaces. Most areas have been disturbed to some degree by construction activity.

4946B—Udorthents-Highway complex, 0 to 5 percent slopes

Component Description

Udorthents and similar soils
Extent: 65 to 75 percent of the unit
Slope range: 0 to 5 percent
Depth to restrictive feature: Very deep (more than 60 inches)
Flooding: None
Ponding: None

Highway
Extent: 25 to 35 percent of the unit
Slope range: 0 to 5 percent
Flooding: None
Ponding: None

5010—Pits, sand and gravel

- 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.

5035—Pits, gypsum quarries

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

5040—Udorthents, loamy (cut and fill land)

Component Description

Udorthents, loamy, and similar soils
Extent: 100 percent of the unit
Depth to restrictive feature: Very deep (more than 60 inches)
Flooding: None
Ponding: None

5049—Aquolls, ponded-Udorthents, loamy, complex

Component Description

Aquolls, ponded, and similar soils
Extent: 60 to 80 percent of the unit
Depth to restrictive feature: Very deep (more than 60 inches)
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Months in which ponding does not occur: January, December
Deepest ponding: 0.5 foot (February, March, April, May, June, July, August, September, October, November)

Udorthents, loamy, and similar soils
Extent: 20 to 40 percent of the unit
Depth to restrictive feature: Very deep (more than 60 inches)
Flooding: None
Ponding: None

5060—Pits, clay

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

5080—Udorthents, sanitary landfill

Component Description

Udorthents and similar soils
Extent: 100 percent of the unit
Depth to restrictive feature: Very deep (more than 60 inches)
Flooding: None
Ponding: None

5457—Du Page silt loam, channeled, 0 to 2 percent slopes, frequently flooded

Component Description

Du Page, channeled, frequently flooded, and similar soils
Extent: 70 to 90 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: Frequent (February, 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: 11.1 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Havelock, occasionally flooded, and similar soils
Extent: 5 to 15 percent of the unit

Lawson, frequently flooded, and similar soils
Extent: 5 to 15 percent of the unit

5507—Corvuso-Brownton complex, 0 to 2 percent slopes

Component Description

Corvuso and similar soils
Extent: 50 to 60 percent of the unit
Position on the landform: Flats and swales
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: Glaciolacustrine deposits over firm basal 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: 9.1 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Brownton and similar soils
Extent: 30 to 40 percent of the unit
Position on the landform: Flats and swales
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: Glaciolacustrine deposits over supraglacial 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: 10.5 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Guckeen and similar soils
Extent: 5 to 10 percent of the unit

Okoboji, depressional, ponded, and similar soils
Extent: 5 to 10 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 2006). 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, 2006). 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.

Angus Series

Typical Pedon

Angus loam, 2 to 5 percent slopes, in an area of oak/hickory timber, on an upland ridge; Webster County, Iowa; 910 feet east and 2,100 feet south of the northwest corner of sec. 15, T. 89 N., R. 29 W.; USGS Clare, Iowa, topographic quadrangle; lat. 42 degrees 31 minutes 28 seconds N. and long. 94 degrees 15 minutes 46 seconds W., NAD 83:

A—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; few very fine and fine roots; neutral; abrupt wavy boundary.

E—7 to 12 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak medium platy; friable; few fine roots; many distinct very dark gray (10YR 3/1) organic coatings on faces of peds; neutral; abrupt wavy boundary.

Bt1—12 to 20 inches; brown (10YR 4/3) clay loam; moderate fine and medium angular and subangular blocky structure; friable; many distinct dark brown (7.5YR 3/3) clay coatings on faces of peds; many distinct light gray (10YR 7/1) silt coatings on faces of peds; about 5 percent shale fragments; about 1 percent gravel; slightly acid; clear smooth boundary.

Bt2—20 to 27 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine and medium angular and subangular blocky structure; friable; many distinct dark brown (7.5YR 3/3) clay coatings on faces of peds; common distinct light gray (10YR 7/1) silt coatings on faces of peds; about 5 percent shale fragments; about 2 percent gravel; slightly acid; gradual smooth boundary.

Bt3—27 to 37 inches; dark yellowish brown (10YR 4/4) loam; moderate medium and fine subangular blocky structure; friable; common distinct dark brown (7.5YR 3/3) clay coatings on faces of peds; about 5 percent shale fragments; about 1 percent gravel; neutral; clear smooth boundary.

Bt4—37 to 51 inches; dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; friable; common distinct dark brown (7.5YR 3/3) clay coatings on faces of peds; few medium distinct strong brown (7.5YR 5/6) redoximorphic concentrations; about 5 percent shale; about 1 percent gravel; neutral; abrupt wavy boundary.

BC—51 to 80 inches; light olive brown (2.5Y 5/3) loam; weak fine and medium subangular blocky structure; friable; common fine dark manganese concretions; common fine and medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; common fine and medium faint light brownish gray (2.5Y 6/2) redoximorphic depletions; about 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 24 to 54 inches

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

E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—1 to 3
Texture—loam
Reaction—moderately acid to neutral

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

Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

C horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 5
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Ankeny Series

Typical Pedon

Ankeny fine sandy loam, 0 to 2 percent slopes, in a cultivated field on a stream terrace; Webster County, Iowa; 960 feet south and 1,650 feet east of the northwest corner of sec. 31, T. 90 N., R. 28 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 34 minutes 19 seconds N. and long. 94 degrees 12 minutes 05 seconds W., NAD 83:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; very weak fine granular structure; very friable; very few very fine and fine roots; slightly acid; abrupt smooth boundary.

A1—8 to 20 inches; very dark gray (10YR 2/1) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; very few very fine roots; slightly acid; gradual smooth boundary.

A2—20 to 29 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; slightly acid; gradual smooth boundary.
A3—29 to 36 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; very weak fine subangular blocky structure parting to weak fine granular; very friable; slightly acid; clear smooth boundary.
Bw1—36 to 46 inches; brown (10YR 4/3) fine sandy loam; very weak fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.
Bw2—46 to 64 inches; dark yellowish brown (10YR 4/4) fine sandy loam; very weak fine subangular blocky structure; very friable; common medium distinct brown (7.5YR 4/4) iron concretions; common fine distinct brown (10YR 5/3) redoximorphic concentrations; neutral; gradual smooth boundary.
2C1—64 to 75 inches; yellowish brown (10YR 5/6) loamy fine sand; single grain; loose; common medium distinct brown (7.5YR 4/4) iron concretions; about 2 percent rock fragments; neutral; clear smooth boundary.
2C2—75 to 80 inches; mixed yellowish brown (10YR 5/6) and brown (10YR 5/3) loamy fine sand; single grain; loose; common medium distinct brown (7.5YR 4/4) iron concretions; about 5 percent rock fragments; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 40 inches
Depth to carbonates: 75 inches or more

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
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 sand, or sand
Reaction—slightly acid to slightly alkaline

Atkinson Series

Typical Pedon

Atkinson loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 465 feet east and 45 feet south of the northwest corner of sec. 18, T. 96 N., R. 10 W.; USGS Protivin SW, Iowa, topographic quadrangle; lat. 43 degrees 08 minutes 27 seconds N. and long. 92 degrees 04 minutes 46 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
Thickness of the mollic epipedon: 10 to 20 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—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 6
Texture—loam, clay loam, or sandy clay loam
Reaction—moderately acid or slightly acid

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

Belview Series

Typical Pedon

Belview loam, on a north-facing, convex slope in a wooded area; Redwood County, Minnesota; 40 feet south and 1,700 feet west of the northeast corner of sec. 35, T. 114 N., R. 37 W.; USGS Iverson Lake, Minnesota, topographic quadrangle; lat. 44 degrees 38 minutes 35 seconds N. and long. 95 degrees 15 minutes 00 seconds W., NAD 83:

A—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; friable; about 9 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 17 inches; brown (10YR 5/3) loam; many very dark gray (10YR 3/1) coatings on faces of peds; weak very fine subangular blocky structure; friable; fine irregularly shaped segregated calcium carbonate in seams; about 13 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bk2—17 to 35 inches; light olive brown (2.5Y 5/4) loam; weak very fine subangular blocky structure; friable; fine irregularly shaped segregated calcium carbonate in seams; few fine masses of calcium carbonate; about 6 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk3—35 to 50 inches; light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; friable; few fine masses of calcium carbonate; about 6 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—50 to 60 inches; light olive brown (2.5Y 5/4) loam; common fine distinct yellowish brown (10R 5/6) iron concentrations; massive; friable; about 8 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches
Carbonates: At the surface

A or Ap horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—loam
- Reaction—slightly alkaline or moderately alkaline

Bk and C horizons:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—3 to 6
- Texture—loam or clay loam
- Reaction—slightly alkaline or moderately alkaline

Billett Series

Typical Pedon

Billett fine sandy loam, 2 to 5 percent slopes, in an area of timber on a stream terrace; Webster County, Iowa; 1,580 feet west and 125 feet north of the southeast corner of sec. 3, T. 86 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 17 minutes 18 seconds N. and long. 93 degrees 58 minutes 15 seconds W., NAD 83:

A—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine

granular; very friable; common very fine and fine roots; moderately acid; abrupt smooth boundary.

E—9 to 16 inches; brown (10YR 4/3) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium platy structure; very friable; common very fine and fine roots; moderately acid; abrupt wavy boundary.

Bt1—16 to 20 inches; brown (10YR 4/3) fine sandy loam; weak fine and medium subangular blocky structure; very friable; few very fine and fine roots; many distinct dark brown (10YR 3/3) clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—20 to 35 inches; brown (7.5YR 4/4) fine sandy loam; weak fine and medium subangular blocky structure; friable; very few very fine and fine roots; many distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—35 to 42 inches; brown (7.5YR 4/4) loam; moderate fine and medium subangular blocky structure; friable; very few very fine roots; many distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; few fine distinct strong brown (7.5YR 5/6) iron masses; slightly acid; clear smooth boundary.

Bt4—42 to 54 inches; brown (7.5YR 4/4) fine sandy loam; weak fine subangular blocky structure; very friable; common distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; few fine distinct strong brown (7.5YR 5/6) iron masses; slightly acid; clear wavy boundary.

Bt5—54 to 78 inches; yellowish brown (10YR 5/4) fine sandy loam; very weak fine subangular blocky structure; very friable; few fine distinct strong brown (7.5YR 5/6) iron masses; common distinct strong brown (7.5YR 4/6) lamellae of sandy loam; slightly acid; abrupt wavy boundary.

C—78 to 80 inches; very pale brown (10YR 7/3) fine sand; single grain; loose; slightly acid.

Range in Characteristics

Depth to carbonates: 60 inches or more

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

E or BE horizon:
- Hue—7.5YR or 10YR
- Value—4 or 5
- Chroma—2 to 4
- Texture—fine sandy loam or sandy loam
- Reaction—strongly acid to neutral

Bt horizon:
- Hue—7.5YR or 10YR
- Value—4 to 6
- Chroma—3 to 6
- Texture—fine sandy loam, sandy loam, or loam
- Reaction—strongly acid to neutral

BC horizon (if it occurs):
- Hue—7.5YR or 10YR
- Value—4 to 7
- Chroma—3 to 6

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

C horizon:
Hue—7.5YR or 10YR
Value—4 to 7
Chroma—3 to 6
Texture—fine sand, loamy fine sand, gravelly fine sand, or gravelly loamy fine sand
Reaction—slightly acid to slightly alkaline

Biscay Series

Typical Pedon

Biscay clay loam, 0 to 2 percent slopes, in a cultivated field on a high stream terrace; Webster County, Iowa; 600 feet west and 75 feet south of the northeast corner of sec. 22, T. 89 N., R. 29 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 30 minutes 54 seconds N. and long. 94 degrees 14 minutes 56 seconds W., NAD 83:

Ap—0 to 8 inches; black (N 2/) clay loam, black (10YR 2/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; friable; neutral; abrupt smooth boundary.
A—8 to 13 inches; black (N 2/) clay loam, black (10YR 2/1) dry; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; friable; slightly acid; clear smooth boundary.
AB—13 to 21 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate fine and medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.
Bg—21 to 30 inches; olive gray (5Y 4/2) clay loam; moderate fine and medium subangular blocky structure; friable; common very fine and fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; neutral; clear smooth boundary.
BCg—30 to 34 inches; olive gray (5Y 4/2) sandy loam; very weak fine subangular blocky structure; very friable; few fine and medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; slightly acid; abrupt wavy boundary.
2Cg1—34 to 59 inches; olive gray (5Y 4/2) loamy sand; single grain; loose; few fine and medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; slightly effervescent; slightly alkaline; gradual smooth boundary.
2Cg2—59 to 80 inches; dark gray (5Y 4/1) gravelly coarse sand; single grain; loose; about 35 percent coarse sand and gravel (a few pebbles are 1 to 3 inches in diameter); strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to contrasting material: 20 to 40 inches
Depth to carbonates: 20 to 40 inches

Ap and A horizons:
Hue—10YR, 2.5Y, or N
Value—2 or 3
Chroma—0 or 1
Texture—clay loam or loam
Reaction—slightly acid to slightly alkaline

Bg horizon:
Hue—2.5Y, 5Y, or 5GY
Value—4 or 5
Chroma—1 to 3
Texture—loam, sandy clay loam, or clay loam
Reaction—neutral or slightly alkaline

BCg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 to 4
Texture—sandy loam or gravelly sandy loam
Reaction—slightly acid to slightly alkaline

2Cg or 2C horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loamy sand, sand, coarse sand, or loamy coarse sand or the gravelly or very gravelly analogs of these textures
Reaction—slightly alkaline or moderately alkaline

Blue Earth Series

Typical Pedon

Blue Earth mucky silt loam, depressional, 0 to 1 percent slopes, in an upland depression in a cultivated field; Webster County, Iowa; 1,266 feet east and 1,243 feet north of the southwest corner of sec. 18, T. 86 N., R. 29 W.; USGS Gowrie, Iowa, topographic quadrangle; lat. 42 degrees 15 minutes 31 seconds N. and long. 94 degrees 16 minutes 36 seconds W., NAD 83:

Ap—0 to 10 inches; black (N 2/) mucky silt loam, very dark gray (N 3/) dry; weak fine granular structure; friable; common very fine roots; about 2 percent fine snail-shell fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.
Lco1—10 to 19 inches; black (N 2/) mucky silt loam; massive; friable; common very fine roots; about 20 to 25 percent fine snail-shell fragments; violently effervescent; moderately alkaline; gradual smooth boundary.
Lco2—19 to 34 inches; black (N 2/) mucky silty clay loam; massive; friable; few very fine roots; about 3 percent fine snail-shell fragments; violently effervescent; moderately alkaline; gradual smooth boundary.
Lco3—34 to 76 inches; very dark gray (5Y 3/1) silty clay loam; massive; friable; few fine prominent strong brown (7.5YR 5/8) iron stains on surfaces along root channels; few coarse faint dark olive gray (5Y 3/2) redoximorphic depletions; about 1 percent fine snail-shell fragments; strongly effervescent; moderately alkaline; clear smooth boundary.
2Cg—76 to 80 inches; grayish brown (2.5Y 5/2) loam; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to glacial till or lacustrine sediments: 30 to more than 80 inches

Ap or A horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2 or 3
Chroma—0 to 2

Texture—mucky silt loam
Reaction—slightly alkaline or moderately alkaline

Lco horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2 to 4
Chroma—0 to 2
Texture—mucky silt loam, mucky silty clay loam, or silty clay loam
Reaction—slightly alkaline or moderately alkaline

2Cg horizon:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—loam, silt loam, clay loam, or silty clay loam
Reaction—slightly alkaline or moderately alkaline

Boone Series

Typical Pedon

Boone loamy fine sand, 25 to 45 percent slopes, in an area of oak/hickory timber in the uplands; Webster County, Iowa; 2,460 feet west and 515 feet north of the southeast corner of sec. 1, T. 87 N., R. 28 W.; USGS Lehigh, Iowa, topographic quadrangle; lat. 42 degrees 22 minutes 11 seconds N. and long. 94 degrees 03 minutes 26 seconds W., NAD 83:

A—0 to 2 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; many very fine and fine roots; slightly acid; abrupt smooth boundary.
E—2 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, grayish brown (10YR 5/2) dry; moderate thin platy structure parting to weak fine subangular blocky; very friable; very few very fine and fine roots; few fine faint dark gray (10YR 4/1) organic coatings on faces of plates; slightly acid; abrupt smooth boundary.
Bw—6 to 16 inches; brown (10YR 5/3) loamy sand; weak medium subangular blocky structure; very friable; very few very fine roots; about 1 percent coarse sandstone fragments; few very fine mica flakes; slightly acid; gradual smooth boundary.
C—16 to 25 inches; pale brown (10YR 6/3) sand; very weak subangular blocky structure parting to single grain; loose; about 1 percent rock fragments; common very fine mica flakes; moderately acid; abrupt wavy boundary.
Cr—25 to 80 inches; pale brown (10YR 6/3), weakly cemented sandstone.

Range in Characteristics

Depth to sandstone bedrock: 20 to 40 inches

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

E horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—2 or 3

Texture—loamy fine sand, loamy sand, or fine sand
Reaction—extremely acid to slightly acid

Bw horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—loamy sand, loamy fine sand, or 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 or fine sand
Reaction—very strongly acid to slightly acid

Brownton Series

Typical Pedon

Brownton silty clay loam, 0 to 2 percent slopes, in a cultivated field in an upland swale; Webster County, Iowa; 272 feet east and 1,200 feet north of the southwest corner of sec. 31, T. 86 N., R. 27 W.; USGS Boxholm, Iowa, topographic quadrangle; lat. 42 degrees 12 minutes 48 seconds N. and long. 94 degrees 02 minutes 48 seconds W., NAD 83:

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

A—7 to 13 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; strongly effervescent; slightly alkaline; gradual smooth boundary.

AB—13 to 18 inches; very dark gray (5Y 3/1) silty clay, dark gray (10YR 4/1) dry; moderate fine and medium subangular blocky structure; firm; common distinct black (10YR 2/1) organic coatings on faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

Bkg1—18 to 24 inches; olive gray (5Y 5/2) silty clay; moderate fine and medium subangular blocky structure; firm; common fine and medium light gray (10YR 7/1) masses of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Bkg2—24 to 34 inches; olive gray (5Y 5/2) silty clay loam; weak fine and medium subangular blocky structure; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; common fine prominent light gray (10YR 7/1) masses of calcium carbonate; few fine prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 1 percent rock fragments; strongly effervescent; moderately alkaline; abrupt wavy boundary.

2BCg—34 to 55 inches; olive gray (5Y 5/2) clay loam; weak medium subangular blocky structure; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; few medium prominent light gray (10YR 7/1) masses of calcium carbonate; common fine and medium prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 4 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Cg—55 to 80 inches; olive gray (5Y 5/2) loam; massive; friable; few fine black (10YR 2/1) iron-manganese concretions; few fine prominent light gray (10YR 7/1) masses

of calcium carbonate; many medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; about 4 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Thickness of the mollic epipedon: 14 to 24 inches
Thickness of lacustrine sediment: 30 to more than 60 inches

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

Bkg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay or silty clay loam
Reaction—slightly alkaline or moderately alkaline

2BCg or 2Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Buckney Series

Typical Pedon

Buckney fine sandy loam, 0 to 2 percent slopes, in a cultivated field on a stream terrace; Webster County, Iowa; 100 feet west and 2,400 feet north of the southeast corner of sec. 3, T. 86 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 17 minutes 15 seconds N. and long. 93 degrees 58 minutes 15 seconds W., NAD 83:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; common very fine roots; neutral; abrupt smooth boundary.
A—9 to 20 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine and medium subangular blocky structure; very friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt wavy boundary.
C1—20 to 47 inches; yellowish brown (10YR 5/4) loamy fine sand with few thin strata of pale brown (10YR 6/3) loamy fine sand; single grain; loose; strongly effervescent; moderately alkaline; gradual smooth boundary.
C2—47 to 80 inches; yellowish brown (10YR 5/4) loamy fine sand with common thin strata of pale brown (10YR 6/3) and light gray (10YR 7/1) loamy fine sand; single grain; loose; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 14 to 24 inches
Depth to carbonates: 8 to 24 inches

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—2 or 3
Texture—fine sandy loam
Reaction—neutral or slightly alkaline

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—loamy fine sand or loamy sand
Reaction—slightly alkaline or moderately alkaline

Calamine Series

Typical Pedon

Calamine silty clay loam, 2 to 5 percent slopes, in a cultivated field in the uplands; Webster County, Iowa; 1,600 feet east and 400 feet south of the northwest corner of sec. 35, T. 88 N., R. 28 W.; USGS Evanston, Iowa, topographic quadrangle; lat. 42 degrees 23 minutes 47 seconds N. and long. 94 degrees 04 minutes 52 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate fine and medium granular; friable; neutral; abrupt smooth boundary.

A1—8 to 15 inches; black (N 2/) silty clay loam, black (10YR 2/1) dry; moderate fine and medium subangular blocky structure parting to moderate fine granular; friable; neutral; gradual smooth boundary.

A2—15 to 20 inches; black (N 2/) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure; friable; neutral; clear smooth boundary.

Btg1—20 to 24 inches; olive gray (5Y 4/2) silty clay loam; moderate fine and medium subangular and angular blocky structure; firm; common fine black (10YR 2/1) clay coatings on faces of peds; common fine prominent yellowish brown (10YR 5/6 and 5/8) redoximorphic concentrations; common fine prominent yellowish brown (10YR 5/6 and 5/8) iron coatings on stones; neutral; abrupt wavy boundary.

2Btg2—24 to 31 inches; dark gray (5Y 4/1) silty clay; moderate fine and medium angular blocky structure; firm; common fine very dark gray (5Y 3/1) clay coatings on faces of peds; common fine and medium prominent olive (5Y 4/3) redoximorphic concentrations; strongly effervescent; slightly alkaline; clear smooth boundary.

2Btgy—31 to 44 inches; mottled dark gray (5Y 4/1) and olive (5Y 5/6) silty clay; strong medium angular and subangular blocky structure; firm; common fine very dark gray (5Y 3/1) clay coatings on faces of peds; many fine clear gypsum crystals; slightly effervescent; slightly alkaline; gradual smooth boundary.

2Cy1—44 to 65 inches; stratified olive (5Y 4/3) and dark gray (5Y 4/1) silty clay; massive with strata of strong medium plates; firm; common fine very dark gray (5Y 3/1) clay coatings on faces of peds; many fine clear gypsum crystals; slightly effervescent; moderately alkaline; gradual smooth boundary.

2Cy2—65 to 80 inches; dark gray (5Y 4/1) silty clay; massive with strata of medium plates; firm; many fine to large clear gypsum crystals; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches
Depth to bedrock: 40 to more than 80 inches

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

Btg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 or 2 where hue is 10YR or 2.5Y; 1 to 3 where hue is 5Y
Texture—silt loam or silty clay loam
Reaction—slightly acid to slightly alkaline

2Btg or 2Btgy horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 or 2 where hue is 10YR or 2.5Y; 1 to 3 where hue is 5Y
Texture—silty clay or silty clay loam
Reaction—neutral or slightly alkaline

2Cy horizon:
Hue—2.5Y, 5Y, or 5GY
Value—4 to 6
Chroma—1 to 6
Texture—silty clay
Reaction—neutral to moderately alkaline

Calcousta Series

Typical Pedon

Calcousta silty clay loam, 0 to 1 percent slopes, in a cultivated field; Pocahontas County, Iowa; 1,860 feet north and 290 feet west of the southeast corner of sec. 29, T. 92 N., R. 31 W.; USGS Rolfe, Iowa, topographic quadrangle; lat. 42 degrees 45 minutes 06 seconds N. and long. 94 degrees 31 minutes 21 seconds W., NAD 83:

Ap—0 to 9 inches; black (N 2/) silty clay loam, very dark gray (N 3/) dry; cloddy parting to weak medium subangular blocky structure; friable; few small snail-shell fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.
A—9 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; krotovina mixing of olive gray (5Y 4/2) in the lower part; some dark gray (5Y 4/1) clay depletions in root channels; slightly effervescent; slightly alkaline; abrupt smooth boundary.
Bg—15 to 21 inches; olive gray (5Y 4/2) silty clay loam; weak fine subangular blocky structure; friable; very dark gray (5Y 3/1) organic coatings on faces of peds; common fine faint olive (5Y 5/4) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.
Cg—21 to 60 inches; olive gray (5Y 5/2) and light olive gray (5Y 6/2) silty clay loam; massive; friable; common fine prominent yellowish red (5YR 4/6) and common medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; few white (5Y 8/1) lime concretions; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 18 inches
Carbonates: Throughout the profile

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

Bg horizon:
Hue—5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay loam
Reaction—slightly alkaline or moderately alkaline

Cg horizon:
Hue—5Y
Value—5 or 6
Chroma—1 or 2
Texture—silt loam or silty clay loam; loam, very fine sandy loam, or clay loam in the lower part in some pedons
Reaction—slightly alkaline or moderately alkaline

Canisteo Series

Typical Pedon

Canisteo clay loam, 0 to 2 percent slopes, in a cultivated field in an upland swale; Webster County, Iowa; 324 feet east and 2,000 feet south of the northwest corner of sec. 13, T. 88 N., R. 29 W.; USGS Fort Dodge South, Iowa, topographic quadrangle; lat. 42 degrees 26 minutes 11 seconds N. and long. 94 degrees 10 minutes 59 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; about 2 percent pebbles; slightly effervescent; slightly alkaline; abrupt smooth boundary.

A—8 to 14 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; about 2 percent pebbles; slightly effervescent; slightly alkaline; clear smooth boundary.

AB—14 to 21 inches; very dark gray (N 3/) clay loam, dark gray (10YR 4/1) dry; weak fine prismatic structure parting to weak fine and medium subangular blocky; friable; few fine and medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; about 2 percent pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

Bkg—21 to 29 inches; dark gray (5Y 4/1) loam; weak fine prismatic structure parting to weak fine and medium subangular blocky; friable; common distinct very dark gray (5Y 3/1) organic coatings on faces of peds; very pale brown (10YR 7/3) calcium carbonate coatings on pebbles; few fine and medium faint grayish brown (2.5Y 5/2) redoximorphic depletions; about 3 percent pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bg—29 to 39 inches; grayish brown (2.5Y 5/2) loam; weak fine prismatic structure parting to weak medium subangular blocky; friable; common very dark gray (5Y

3/1) organic coatings on faces of peds; few fine prominent black (10YR 2/1) manganese concretions; few medium prominent light gray (10YR 7/1) masses of calcium carbonate; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 4 percent pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

BCg—39 to 50 inches; olive gray (5Y 5/2) loam; weak medium prismatic structure; friable; few fine prominent black (10YR 2/1) manganese concretions; few medium prominent light gray (10YR 7/1) masses of calcium carbonate; few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 5 percent pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg1—50 to 64 inches; olive gray (2.5Y 5/2) loam; massive; friable; few fine black (10YR 2/1) manganese concretions; common fine and medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 5 percent pebbles; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg2—64 to 80 inches; light brownish gray (2.5Y 6/2) loam; massive; friable; many medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 5 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

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

Ap or A horizon:
Hue—10YR or N
Value—2 or 3
Chroma—0 or 1
Texture—clay loam or silty clay loam
Reaction—slightly alkaline or moderately alkaline

Bg and Bkg horizons:
Hue—10YR, 2.5Y, or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—1 to 4
Texture—loam or sandy loam
Reaction—slightly alkaline or moderately alkaline

Clarion Series

Typical Pedon

Clarion loam, 2 to 5 percent slopes, in a cultivated field in the uplands; Webster County, Iowa; 2,000 feet west and 1,811 feet north of the southeast corner of sec. 6, T. 86 N., R. 29 W.; USGS Gowrie, Iowa, topographic quadrangle; lat. 42 degrees 17 minutes 14 seconds N. and long. 94 degrees 16 minutes 11 seconds W., NAD 83:

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; about 2 percent pebbles; moderately acid; abrupt smooth boundary.

A—9 to 16 inches; very dark grayish brown (10YR 3/1) loam, dark grayish brown (10YR 4/1) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; about 2 percent pebbles; moderately acid; clear smooth boundary.
Bw1—16 to 21 inches; dark brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; about 2 percent pebbles; slightly acid; clear smooth boundary.
Bw2—21 to 31 inches; dark yellowish brown (10YR 4/4) loam; weak medium and fine subangular blocky structure; friable; about 3 percent pebbles; neutral; abrupt wavy boundary.
Bk—31 to 42 inches; yellowish brown (10YR 5/4) loam; weak medium and fine subangular blocky structure; friable; common fine and medium prominent light gray (10YR 7/2) masses of calcium carbonate; few fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations and few fine distinct light grayish brown (2.5Y 6/2) redoximorphic depletions; about 5 percent pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.
C1—42 to 54 inches; yellowish brown (10YR 5/4) loam; massive; friable; few medium prominent light gray (10YR 7/2) masses of calcium carbonate; many fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations and common fine and medium distinct light grayish brown (2.5Y 6/2) redoximorphic depletions; about 5 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary.
C2—54 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; few medium prominent light gray (10YR 7/2) masses of calcium carbonate; few fine distinct yellowish red (5YR 5/8) redoximorphic concentrations; light brownish gray (2.5Y 6/2) redoximorphic depletions; about 5 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 18 to 50 inches
Thickness of the mollic epipedon: 10 to 20 inches

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

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

Bk horizon (if it occurs):
Hue—10YR
Value—4 to 6
Chroma—3 or 4
Texture—loam or sandy loam
Reaction—slightly alkaline or moderately alkaline

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

Texture—loam or sandy loam
Reaction—slightly alkaline or moderately alkaline

Taxadjunct features: The Clarion soils in map units 138C2 and 638C2 do not have a mollic epipedon. These soils are classified as fine-loamy, mixed, superactive, mesic Typic Eutrudepts.

Cokato Series

Typical Pedon

Cokato loam, 9 to 14 percent slopes, in a cultivated field on a footslope; Webster County, Iowa; 328 feet east and 1,482 feet north of the southwest corner of sec. 22, T. 86 N., R. 27 W.; USGS Fraser, Iowa, topographic quadrangle; lat. 42 degrees 14 minutes 33 seconds N. and long. 93 degrees 59 minutes 20 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 subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; moderately acid; abrupt smooth boundary.

A—7 to 14 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; moderately acid; clear smooth boundary.

Bt1—14 to 20 inches; dark grayish brown (10YR 4/3) loam; weak fine prismatic structure parting to moderate medium subangular blocky; friable; common fine and very fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; common prominent light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt2—20 to 33 inches; brown (10YR 4/3) loam; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; few prominent light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt3—33 to 43 inches; brown (10YR 4/3) loam; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; common distinct dark brown (10YR 3/3) clay films on faces of peds; neutral; clear smooth boundary.

Bt4—43 to 52 inches; brown (10YR 4/3) loam; weak medium prismatic structure; friable; few distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concretions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual smooth boundary.

Bt5—52 to 67 inches; dark yellowish brown (10YR 4/4) loam; weak coarse prismatic structure; friable; few distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concretions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual smooth boundary.

C—67 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; few distinct very dark grayish brown (10YR 3/2) clay films along surfaces of root channels; few fine prominent black (10YR 2/1) iron and manganese concretions; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches

Ap and A horizons:
Hue—10YR
Value—2 or 3

Chroma—1 to 3
Texture—loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—10YR in the upper part; 10YR or 2.5Y in the lower part
Value—4 or 5
Chroma—3 or 4
Texture—loam, sandy clay loam, or clay loam
Reaction—moderately acid to neutral

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—3 to 5
Texture—loam
Reaction—neutral to moderately alkaline

Coland Series

Typical Pedon

Coland clay loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; Webster County, Iowa; 240 feet east and 420 feet north of the southwest corner of sec. 33, T. 86 N., R. 30 W.; USGS Paton, Iowa, topographic quadrangle; lat. 42 degrees 12 minutes 44 seconds N. and long. 94 degrees 21 minutes 30 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.
A1—7 to 31 inches; black (N 2/) clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; neutral; gradual smooth boundary.
A2—31 to 47 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine prismatic structure parting to weak medium subangular blocky; friable; few fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; neutral; clear smooth boundary.
AB—47 to 54 inches; very dark gray (5Y 3/1) loam with thin strata of sandy loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine faint black (10YR 2/1) iron and manganese concretions; common fine and medium prominent strong brown (7.5YR 4/6) redoximorphic concentrations; neutral; clear smooth boundary.
Cg1—54 to 73 inches; dark gray (5Y 4/1) loam; massive; friable; few fine distinct black (10YR 2/1) iron and manganese concretions; common fine and medium prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; slightly effervescent; slightly alkaline; gradual smooth boundary.
Cg2—73 to 80 inches; olive gray (5Y 5/2) loam; massive; friable; few fine prominent black (10YR 2/1) iron and manganese concretions; many medium and coarse prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; about 2 percent rock fragments; slightly effervescent; slightly alkaline.

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—clay loam
Reaction—slightly acid or 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

Cg horizon:
Hue—2.5Y or 5Y or N
Value—2 to 5
Chroma—0 to 2
Texture—clay loam, loam, or sandy loam
Reaction—slightly acid to slightly alkaline

Collinwood Series

Typical Pedon

Collinwood silty clay loam, 0 to 3 percent slopes, in a cultivated field; Faribault County, Minnesota; 1,450 feet east and about 850 feet north of the southwest corner of sec. 9, T. 102 N., R. 27 W.; USGS Blue Earth, Minnesota, topographic quadrangle; lat. 43 degrees 38 minutes 58 seconds N. and long. 94 degrees 05 minutes 12 seconds W., NAD 83:

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; moderately acid; abrupt smooth boundary.
A—10 to 16 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; moderately acid; abrupt smooth boundary.
BA—16 to 21 inches; very dark grayish brown (10YR 3/2) silty clay; moderate fine subangular blocky structure; firm; few very dark gray (10YR 3/1) coatings on peds; moderately acid; clear smooth boundary.
Bw—21 to 32 inches; olive brown (2.5Y 4/4) clay; moderate fine prismatic structure; few fine faint dark grayish brown (2.5Y 4/2) iron depletions and few fine faint light olive brown (2.5Y 5/6) iron concentrations; moderately acid; clear wavy boundary.
C1—32 to 45 inches; yellowish brown (10YR 5/4) silty clay; massive (varved); firm; common medium distinct gray (10YR 6/1) and few fine distinct strong brown (7.5YR 5/6) iron concentrations; few fine distinct black (10YR 2/1) manganese oxide granules; slightly effervescent; slightly alkaline; clear smooth boundary.
C2—45 to 60 inches; yellowish brown (10YR 5/4) silty clay; massive; friable; common medium distinct gray (10YR 6/1) iron depletions and faint pale brown (10YR 6/3) iron concentrations; few strong brown (7.5YR 5/8) iron oxide stains; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 14 to 24 inches
Depth to carbonates: 24 to 50 inches

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

Bw horizon:
Hue—10YR or 2.5Y in the upper part; 2.5Y in the lower part
Value—3 to 5
Chroma—2 to 4
Texture—silty clay, clay, or silty clay loam
Reaction—moderately acid or slightly acid

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

Copaston Series

Typical Pedon

Copaston sandy clay loam, on a slightly convex slope of 2 percent, on a rock-cored terrace in a pastured field; Rice County, Minnesota; 980 feet east and 900 feet south of the center of sec. 2, T. 111 N., R. 20 W.; USGS Northfield, Minnesota, topographic quadrangle; lat. 44 degrees 26 degrees 50 minutes N. and long. 93 degrees 11 minutes 15 seconds W., NAD 83:

A—0 to 7 inches; very dark brown (10YR 2/2) sandy clay loam, very dark grayish brown (10YR 3/2) dry; weak very fine and fine subangular blocky structure; friable; about 2 percent gravel; neutral; clear smooth boundary.
AB—7 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine subangular blocky structure; friable; about 2 percent gravel; moderately acid; clear wavy boundary.
Bw—11 to 18 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; friable; dark brown (10YR 3/3) coatings on faces of peds; about 5 percent gravel; slightly acid; abrupt wavy boundary.
2R—18 inches; limestone bedrock.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to bedrock: 10 to 20 inches

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

Bw horizon:
Hue—7.5YR or 10YR

Value—3 or 4
Chroma—1 to 4
Texture—sandy loam, loam, or clay loam
Reaction—moderately acid to slightly alkaline

Cordova Series

Typical Pedon

Cordova clay loam, 0 to 2 percent slopes, in a cultivated field on an upland flat; Webster County, Iowa; 1,900 feet west and 1,660 feet north of the southeast corner of sec. 14, T. 87 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 20 minutes 39 seconds N. and long. 93 degrees 57 minutes 31 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) clay loam, very dark gray (N 3/) dry; weak fine and medium subangular blocky structure; friable; about 2 percent gravel; neutral; abrupt smooth boundary.

A—7 to 13 inches; black (N 2/) clay loam, very dark gray (N 3/) dry; weak fine and medium subangular blocky structure parting to weak fine granular; friable; about 2 percent gravel; neutral; clear smooth boundary.

Btg1—13 to 20 inches; very dark gray (5Y 3/1) clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; common distinct black (N 2/) clay films on faces of peds; few fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; about 2 percent gravel; neutral; gradual smooth boundary.

Btg2—20 to 31 inches; olive gray (5Y 5/2) silty clay loam; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; common distinct very dark gray (5Y 3/1) clay films on faces of peds; few fine distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; about 2 percent gravel; neutral; clear smooth boundary.

Btg3—31 to 38 inches; olive gray (5Y 5/2) silty clay loam; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; friable; common distinct dark gray (5Y 4/1) clay films on faces of peds; few fine distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; about 2 percent gravel; neutral; gradual smooth boundary.

Bkg—38 to 53 inches; light olive gray (5Y 6/2) clay loam; weak medium prismatic structure; friable; common distinct dark gray (5Y 4/1) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concentrations; common very pale brown (10YR 7/3) calcium carbonate masses and threads; common fine and medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 3 percent gravel; slightly effervescent; slightly alkaline; abrupt wavy boundary.

Cg1—53 to 65 inches; olive gray (5Y 5/2) loam; massive; friable; few fine prominent black (10YR 2/1) iron and manganese concentrations; many medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 4 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg2—65 to 80 inches; olive gray (5Y 5/2) loam; massive; friable; few fine and medium prominent black (10YR 2/1) iron and manganese concentrations; many coarse prominent yellowish brown (10YR 5/6) and few medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; about 4 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

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

Ap and A horizons:
Hue—10YR, 2.5Y, or N
Value—2 or 3
Chroma—0 or 1
Texture—clay loam
Reaction—neutral to moderately acid

Btg horizon:
Hue—10YR to 5Y
Value—3 in the upper part; 3 to 5 in the lower part
Chroma—1 or 2
Texture—silty clay loam or clay loam
Reaction—strongly acid to slightly alkaline

Bk, C, or Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Corvuso Series

Typical Pedon

Corvuso silty clay loam, 0 to 2 percent slopes, on the rim of a depression in a cultivated field; Renville County, Minnesota; 2,175 feet south and 200 feet east of the northwest corner of sec. 22, T. 116 N., R. 32 W.; USGS Churchill, Minnesota, topographic quadrangle; lat. 44 degrees 50 minutes 30 seconds N. and long. 94 degrees 41 minutes 27 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine angular blocky structure; firm; few fine roots; about 1 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.
Ak—7 to 15 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate fine and medium angular blocky structure; friable; few fine roots; carbonates disseminated throughout; about 1 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.
ABkg—15 to 20 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium angular blocky structure; friable; carbonates disseminated throughout; about 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.
Bkg1—20 to 30 inches; dark grayish brown (2.5Y 4/2) clay; weak medium angular blocky structure; firm; carbonates disseminated throughout; few fine distinct light olive brown (2.5Y 5/3) iron concentrations; about 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.
2Bkg2—30 to 47 inches; olive gray (5Y 4/2) clay loam; weak coarse subangular blocky structure; firm; carbonates disseminated throughout; few medium distinct olive brown (2.5Y 4/4) iron concentrations; few yellowish red iron stains on ped exteriors; about 3 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2BCg—47 to 80 inches; olive gray (5Y 5/2) clay loam; moderate extremely coarse and coarse prismatic structure; firm; carbonates segregated in few light gray (10YR 7/2) rounded soft masses; common medium distinct light olive brown (2.5Y 5/4) iron concentrations; few yellowish red iron stains on ped exteriors; about 4 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches

A, Ap, or Ak horizon:
Hue—10YR or N
Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam, silty clay, or clay loam
Reaction—slightly alkaline or moderately alkaline

AB horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam, silty clay, or clay loam
Reaction—slightly alkaline or moderately alkaline

Bkg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay, clay, silty clay loam, or clay loam
Reaction—moderately alkaline

2Bkg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay, silty clay loam, or clay loam
Reaction—moderately alkaline

2BCg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

Cosmos Series

Typical Pedon

Cosmos clay loam, 0 to 3 percent slopes, in a bluegrass/timbered wildlife area on a high stream terrace; Webster County, Iowa; 1,000 feet west and 2,250 feet south of the northeast corner of sec. 20, T. 87 N., R. 27 W.; USGS Lehigh, Iowa, topographical quadrangle; lat. 42 degrees 20 minutes 01 second N. and long. 94 degrees 00 minutes 50 seconds W., NAD 83:

A1—0 to 11 inches; black (N 2/) clay loam, very dark gray (10YR 3/) dry; moderate fine granular structure; friable; few very fine and fine roots; slightly acid; gradual smooth boundary.

A2—11 to 18 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate fine angular and subangular blocky structure parting to moderate fine granular; friable; very few fine roots; few fine and medium distinct dark grayish brown (2.5Y 4/2) redoximorphic depletions; slightly acid; clear smooth boundary.

Btg—18 to 26 inches; dark gray (2.5Y 4/1) clay loam; weak fine subangular blocky structure; friable; few medium prominent yellowish red (5YR 5/6) iron concretions; common fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; common fine and medium faint dark grayish brown (2.5Y 4/2) redoximorphic depletions; few distinct olive brown (2.5Y 4/3) clay coatings on faces of peds; thin stone line in the lower part of the horizon; neutral; abrupt wavy boundary.

2Bkg1—26 to 39 inches; gray (5Y 5/2) clay loam; weak coarse prismatic structure parting to moderate medium angular blocky; firm; few medium prominent yellowish brown (10YR 5/6) iron concretions; common fine to coarse white (10YR 8/1) calcium carbonate nodules; many medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 3 percent rock fragments; strongly effervescent; slightly alkaline; gradual smooth boundary.

2Bkg2—39 to 66 inches; olive gray (5Y 5/2) clay loam; weak coarse prismatic structure; very firm; few fine black (10YR 2/1) manganese concretions; common fine to coarse white (10YR 8/1) calcium carbonate nodules; many medium and coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 4 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Cg—66 to 80 inches; olive gray (5Y 4/2) clay loam; massive; very firm; few fine dark manganese concretions; few distinct white (10YR 8/1) calcium carbonate nodules; few medium faint gray (5Y 5/1) redoximorphic depletions; about 4 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 14 to 24 inches
Depth to carbonates: 16 to 40 inches

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

Btg horizon:
- Hue—2.5Y or 5Y
- Value—4 or 5
- Chroma—1 or 2
- Texture—clay loam or silty clay loam
- Reaction—slightly acid or neutral

2Bkg horizon:
- Hue—2.5Y or 5Y
- Value—4 or 5
- Chroma—1 or 2
- Texture—clay loam or silty clay loam
- Reaction—slightly alkaline or moderately alkaline

2Cg horizon:
- Hue—5Y or 2.5Y
- Value—4 or 5

Chroma—1 or 2
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Crippin Series

Typical Pedon

Crippin loam, 1 to 3 percent slopes, in a cultivated field; Palo Alto County, Iowa; 44 feet south and 2,000 feet east of the northwest corner of sec. 21, T. 97 N., R. 32 W.; USGS Graettinger East, Iowa, topographic quadrangle; lat. 43 degrees 12 minutes 44 seconds N. and long. 94 degrees 37 minutes 55 seconds W., NAD 83:

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

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Carbonates: Throughout the profile

Ap and A horizons:
Hue—10YR or N
Value—2 or 3
Chroma—0 or 1
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

AB horizon (if it occurs):
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

BA horizon (if it occurs):
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Bw or Bg horizon:
Hue—10YR or 2.5Y
Value—4
Chroma—2
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

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

Cylinder Series

Typical Pedon

Cylinder loam, 0 to 2 percent slopes, in a cultivated field on a stream terrace; Webster County, Iowa; 2,500 feet south and 2,420 feet east of the northwest corner of sec. 10, T. 89 N., R. 29 W.; USGS Clare, Iowa, topographic quadrangle; lat. 42 degrees 32 minutes 16 seconds N. and long. 94 degrees 15 minutes 25 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common very fine and fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.

A1—7 to 15 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; about 3 percent gravel; slightly acid; clear smooth boundary.

A2—15 to 19 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (2.5Y 5/2) dry; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; few distinct black (10YR 2/1) coatings on faces of peds; about 3 percent gravel; slightly acid; clear smooth boundary.

Bg—19 to 29 inches; dark grayish brown (2.5Y 4/2) loam; weak medium subangular blocky structure; friable; common very fine roots; few fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; about 5 percent gravel; neutral; abrupt smooth boundary.

2Cg1—29 to 55 inches; grayish brown (2.5Y 5/2) gravelly loamy sand; single grain; loose; few fine prominent yellowish brown (10YR 5/6) iron concretions; about 20 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

2Cg2—55 to 80 inches; light brownish gray (2.5Y 6/2) gravelly loamy sand; single grain; loose; about 25 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 14 to 24 inches
Depth to contrasting material: 24 to 40 inches

Ap and A horizons:
Hue—10YR or 2.5Y
Value—2 or 3
Chroma—1 or 2
Texture—loam
Reaction—moderately acid to neutral

Bg or Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2 or 3
Texture—loam or clay loam
Reaction—slightly acid or neutral

2C or 2Cg horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—2 to 8
Texture—sand, loamy sand, gravelly sand, or gravelly loamy sand
Reaction—slightly alkaline or moderately alkaline

Dickinson Series

Typical Pedon

Dickinson fine sandy loam, 2 to 5 percent slopes, in a cultivated field; Mitchell County, Iowa; 435 feet north and 180 feet east of the southwest corner of sec. 23, T. 100 N., R. 17 W.; USGS Stacyville, Iowa, topographic quadrangle; lat. 43 degrees 27 minutes 34 seconds N. and long. 92 degrees 49 minutes 47 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A1—9 to 14 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; many distinct very dark brown (10YR 2/2) coatings on faces of peds; slightly acid; gradual smooth boundary.
A2—14 to 18 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; many distinct very dark grayish brown (10YR 3/2) coatings on faces of peds; moderately acid; clear smooth boundary.
Bw1—18 to 24 inches; brown (10YR 4/3) fine sandy loam; weak fine subangular blocky structure; very friable; many distinct dark brown (10YR 3/3) coatings on faces of peds; moderately acid; gradual smooth boundary.
Bw2—24 to 30 inches; brown (10YR 4/3) fine sandy loam; weak fine subangular blocky structure; very friable; moderately acid; clear smooth boundary.
BC—30 to 36 inches; yellowish brown (10YR 5/4) loamy sand; weak coarse prismatic structure; very friable; moderately acid; clear smooth boundary.
C—36 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; moderately acid.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 20 inches
Depth to carbonates: More than 60 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 or 2.5Y
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 fine sand, loamy sand, fine sand, or sand
Reaction—moderately acid to neutral

2C horizon (if it occurs):
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 to 4
Texture—loam, clay loam, silt loam, silty clay loam, silty clay, or clay
Reaction—slightly alkaline or moderately alkaline

Dickman Series

Typical Pedon

Dickman sandy loam, on a convex slope of 1 percent, on a glacial outwash plain in a cultivated field; Redwood County, Minnesota; about 1.5 miles north of Redwood Falls; 2,240 feet west and 2,500 feet south of the northeast corner of sec. 25, T. 113 N., R. 36 W.; USGS Redwood Falls, Minnesota, topographic quadrangle; lat. 44 degrees 33 minutes 53 seconds N. and long. 95 degrees 07 minutes 21 seconds W., NAD 27:

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.
A—10 to 12 inches; very dark gray (10YR 3/1) sandy loam, dark brown (10YR 3/3) dry; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.
Bw1—12 to 16 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.
Bw2—16 to 19 inches; brown (10YR 4/3) sandy loam; dark grayish brown (10YR 4/2) on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.
2Bw3—19 to 33 inches; brown (10YR 4/3) loamy sand; single grain; loose; neutral; clear smooth boundary.

2C1—33 to 68 inches; yellowish brown (10YR 5/4) coarse sand; single grain; loose; neutral; gradual wavy boundary.
2C2—68 to 80 inches; brown (10YR 5/3) sand; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches
Depth to carbonates: More than 30 inches

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

Bw horizon:
Hue—10YR or 7.5YR
Value—3 or 4
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, or fine sandy loam
Reaction—moderately acid to neutral

2Bw horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loamy sand, loamy fine sand, fine sand, coarse sand, or sand
Reaction—moderately acid to neutral

2C horizon;
Hue—7.5YR, 10YR, or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—coarse sand, sand, or fine sand or strata of these textures
Reaction—slightly acid to slightly alkaline

Du Page Series

Typical Pedon

Du Page silt loam, 0 to 2 percent slopes, frequently flooded, in an area of timber on a flood plain; Webster County, Iowa; 505 feet west and 500 feet north of the southeast corner of sec. 25, T. 87 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 18 minutes 44 seconds N. and long. 93 degrees 56 minutes 0.5 second W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark gray (10YR 4/1) dry; very weak fine granular structure; friable; slightly effervescent; slightly alkaline; abrupt wavy boundary.
A1—7 to 24 inches; very dark grayish brown (10YR 3/2) loam with strata of light brownish gray (10YR 6/2) and very dark gray (10YR 3/1); weak medium subangular blocky structure; friable; slightly effervescent; slightly alkaline; gradual smooth boundary.
A2—24 to 35 inches; very dark grayish brown (10YR 3/2) loam with thin strata of very dark gray (10YR 3/1) and light brownish gray (10YR 6/2); few lenses of light

brownish gray (10YR 6/2) very fine sand; weak medium subangular blocky structure; friable; slightly effervescent; moderately alkaline; abrupt wavy boundary.
C—35 to 80 inches; dark brown (10YR 3/3) loam; massive; friable; black (10YR 2/1) krotovina from 44 to 46 inches; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 52 inches
Depth to carbonates: 0 to 10 inches

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

C horizon:
Hue—10YR
Value—3 or 4
Chroma—1 to 4
Texture—loam, sandy loam, or silt loam
Reaction—slightly alkaline or moderately alkaline

Dundas Series

Typical Pedon

Dundas silt loam, 0 to 2 percent slopes, in an area of grassland on an upland flat; Webster County, Iowa; 1,450 feet east and 2,500 feet south of the northwest corner of sec. 26, T. 87 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 19 minutes 06 seconds N. and long. 93 degrees 57 minutes 55 seconds W., NAD 83:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine roots; slightly acid; abrupt smooth boundary.
E1—8 to 12 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/1) dry; moderate thin platy structure; friable; very few very fine roots; few fine prominent strong brown (7.5YR 4/6) masses of iron on faces of peds; slightly acid; clear smooth boundary.
E2—12 to 16 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/1) dry; moderate thick platy structure parting to weak fine subangular blocky; friable; few fine prominent strong brown (7.5YR 4/6) masses of iron on faces of peds; slightly acid; abrupt wavy boundary.
Btg1—16 to 27 inches; dark gray (2.5Y 4/1) clay loam; moderate fine prismatic structure parting to moderate medium and fine angular and subangular blocky; firm; common distinct very dark gray (2.5Y 3/1) clay films along surfaces of root channels; common prominent light gray (10YR 7/1) silt coatings on faces of peds; few fine and medium prominent yellowish red (5YR 5/8) masses of iron on faces of peds; about 1 percent rock fragments; slightly acid; gradual smooth boundary.
Btg2—27 to 33 inches; dark gray (2.5Y 4/1) clay loam; strong fine prismatic structure parting to moderate fine and medium angular blocky; firm; common distinct very dark gray (2.5Y 3/1) clay films along surfaces of root channels; many prominent light gray (10YR 7/1) silt coatings on faces of peds; common fine and medium prominent yellowish red (5YR 5/8) masses of iron on faces of peds; about 2 percent rock fragments; slightly acid; clear smooth boundary.

Btg3—33 to 44 inches; dark grayish brown (2.5Y 5/2) sandy clay loam; weak fine and medium subangular blocky structure; firm; common distinct very dark gray (2.5Y 3/1) clay films along surfaces of root channels; few prominent light gray (10YR 7/1) silt coatings on faces of peds; few fine prominent yellowish red (5YR 5/8) masses of iron on faces of peds; about 3 percent rock fragments; moderately acid; clear smooth boundary.
Btg4—44 to 52 inches; dark grayish brown (2.5Y 4/2) clay loam; weak fine and medium subangular blocky structure; firm; many coarse prominent yellowish brown (10YR 5/8) masses of iron on faces of peds; about 1 percent rock fragments; slightly acid; gradual smooth boundary.
Cg1—52 to 64 inches; mottled grayish brown (2.5Y 6/2) and yellowish brown (10YR 5/6) loam; massive; firm; about 2 percent rock fragments; slightly effervescent; slightly alkaline; abrupt wavy boundary.
Cg2—64 to 80 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) loam; massive; about 3 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 55 inches

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

E horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2
Texture—silt loam
Reaction—strongly acid to slightly acid

Btg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 to 3
Texture—silty clay loam, loam, clay loam, or clay in the upper part; clay loam, sandy clay loam, or loam in the lower part
Reaction—strongly acid to slightly acid

Cg or C horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 to 3
Texture—loam, clay loam, or sandy loam
Reaction—slightly alkaline or moderately alkaline

Emeline Series

Typical Pedon

Emeline loam, on a slope of 2 percent in a bluegrass pasture; Jones County, Iowa; 400 feet west and 2,040 feet north of the southeast corner of sec. 10, T. 86 N., R. 3 W.; lat.

42 degrees 16 minutes 21 seconds N. and long. 91 degrees 10 minutes 15 seconds W., NAD 83:

A—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; many fine and very fine roots; few fragments of weathered limestone in the lower 4 inches (about 12 percent of the soil volume); neutral; abrupt wavy boundary.
2R—9 inches; indurated level-bedded limestone bedrock; some dark loamy sediments in cracks in the upper part.

Range in Characteristics

Thickness of the mollic epipedon: 4 to 10 inches
Depth to bedrock: 4 to 10 inches

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

Estherville Series

Typical Pedon

Estherville sandy loam, 2 to 5 percent slopes, in a cultivated field; Webster County, Iowa; 2,250 feet west and 840 feet south of the northeast corner of sec. 1, T. 89 N., R. 29 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 33 minutes 21 seconds N. and long. 94 degrees 12 minutes 57 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure; very friable; common very fine and fine roots; slightly acid; gradual smooth boundary.
A—9 to 14 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; very friable; common very fine roots; slightly acid; clear smooth boundary.
Bw1—14 to 19 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; few very fine roots; common distinct very dark brown (10YR 2/2) organic coatings on faces of peds; slightly acid; abrupt wavy boundary.
2Bw2—19 to 30 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; about 10 percent rock fragments; moderately acid; abrupt wavy boundary.
2C1—30 to 46 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 25 percent fine gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.
2C2—46 to 80 inches; pale brown (10YR 6/3) gravelly coarse sand; single grain; loose; about 30 percent fine and medium gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the loamy mantle: 10 to 20 inches
Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 12 to 40 inches

Ap or A horizon:
Hue—10YR

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

Bw horizon:
Hue—10YR or 7.5YR
Value—3 or 4
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, or loam
Reaction—moderately acid to neutral

2Bw horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—2 to 4
Texture—loamy sand, sand, coarse sand, or loamy coarse sand
Reaction—moderately acid to neutral

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 7
Chroma—2 to 6
Texture—coarse sand, sand, gravelly coarse sand, or gravelly sand
Reaction—slightly alkaline or moderately alkaline

Faxon Series

Typical Pedon

Faxon clay loam, in a shallow depression on a rock-cored terrace in an idle field; Rice County, Minnesota; 1,800 feet north and 460 feet east of the southwest corner of sec. 14, T. 111 N., R. 20 W.; USGS Northfield, Minnesota, topographic quadrangle; lat. 44 degrees 25 minutes 07 seconds N. and long. 93 degrees 11 minutes 56 seconds W., NAD 83:

A1—0 to 10 inches; black (N 2/) clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; slightly effervescent; slightly alkaline; clear wavy boundary.
A2—10 to 15 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; friable; slightly alkaline; clear wavy boundary.
Bg1—15 to 20 inches; dark gray (10YR 4/1) loam; weak fine and medium subangular blocky structure; friable; many fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; slightly alkaline; clear wavy boundary.
Bg2—20 to 26 inches; gray (5Y 5/1) fine sandy loam; weak medium prismatic structure; friable; many coarse prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; slightly alkaline; abrupt wavy boundary.
Bg3—26 to 34 inches; greenish gray (5GY 5/1) loam; weak medium prismatic structure; friable; many coarse prominent strong brown (7.5YR 5/8) redoximorphic concentrations; about 5 percent rock fragments; slightly alkaline; abrupt smooth boundary.
2R—34 inches; limestone bedrock.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to bedrock: 20 to 40 inches

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

Bg horizon:
Hue—10YR, 2.5Y, 5Y, 5GY, or N
Value—4 or 5
Chroma—0 to 2 in the upper part; 0 to 4 in the lower part
Texture—loam, clay loam, or silty clay loam
Reaction—neutral or slightly alkaline

Fort Dodge Series

Typical Pedon

Fort Dodge loam, 2 to 5 percent slopes, in a cultivated field; Webster County, Iowa; 280 feet east and 340 feet north of the southwest corner of sec. 29, T. 90 N., R. 30 W.; USGS Gilmore City SW, Iowa, topographic quadrangle; lat. 42 degrees 34 minutes 26 seconds N. and long. 94 degrees 25 minutes 19 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; abrupt smooth boundary.
A1—7 to 17 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
A2—17 to 31 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
A3—31 to 39 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
Bw1—39 to 50 inches; brown (10YR 4/3) loam; weak fine and medium subangular blocky structure; friable; common distinct very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) organic stains on faces of peds; about 2 percent rock fragments in the lower part; neutral; clear smooth boundary.
Bw2—50 to 58 inches; dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; friable; few fine tubular pores; common distinct dark brown (10YR 3/3) organic stains on faces of peds; about 3 percent rock fragments; many fine shale fragments; neutral; abrupt wavy boundary.
2C—58 to 80 inches; dark yellowish brown (10YR 4/4) loamy coarse sand; single grain; loose; about 3 percent rock fragments; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 55 inches
Depth to sand or loamy sand: 40 to 60 inches
Depth to carbonates: More than 40 inches

Other features: Some pedons have a Bk horizon, which has colors and textures similar to those 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 and BC horizon (if it occurs):
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—3 to 6
Texture—loam, clay loam, or sandy loam
Reaction—slightly acid or neutral

2C horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—3 to 8
Texture—sand, coarse sand, loamy sand, or loamy coarse sand or the gravelly analogs of these textures
Reaction—slightly acid to moderately alkaline

Garmore Series

Typical Pedon

Garmore loam, 0 to 2 percent slopes, in a cultivated field; Humboldt County, Iowa; 1,250 feet east and 75 feet south of the northwest corner of sec. 14, T. 91 N., R. 30 W.; USGS Unique, Iowa, topographic quadrangle; lat. 42 degrees 42 minutes 07 seconds N. and long. 94 degrees 21 minutes 43 seconds W., NAD 83:

Ap—0 to 6 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; common fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.
A1—6 to 11 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; common fine roots; about 2 percent gravel; neutral; gradual smooth boundary.
A2—11 to 17 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; about 2 percent gravel; neutral; gradual smooth boundary.
AB—17 to 21 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; common fine roots; about 2 percent gravel; neutral; clear smooth boundary.
Bw1—21 to 36 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; friable; common fine roots; dark brown (10YR 3/3) coatings on faces of peds; about 3 percent gravel; slightly acid; gradual smooth boundary.
Bw2—36 to 43 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine and medium subangular blocky structure; friable; few fine distinct dark grayish brown (10YR 4/2) iron depletions; few fine distinct light olive brown (2.5Y 5/4) iron concentrations; about 3 percent gravel; moderately acid; clear smooth boundary.
Bw3—43 to 49 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure; friable; common medium distinct dark grayish brown (10YR 4/2)

and few fine distinct grayish brown (2.5Y 5/2) iron depletions; about 3 percent gravel; slightly acid; gradual smooth boundary.

BC—49 to 62 inches; light olive brown (2.5Y 5/6) loam; weak coarse prismatic structure; friable; few oxide stains on vertical faces of peds; few dark grayish brown (10YR 4/2) coatings on faces of peds; few fine distinct grayish brown (2.5Y 5/2) iron depletions; about 5 percent gravel; slightly acid; clear smooth boundary.

C—62 to 80 inches; light olive brown (2.5Y 5/6) loam; massive; friable; few fine prominent grayish brown (2.5Y 5/2) iron depletions; few fine prominent strong brown (7.5YR 5/8) iron concentrations; about 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 50 to 70 inches
Thickness of the mollic epipedon: 10 to 24 inches

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

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

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

BC and C horizons:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—4 to 6
Texture—loam
Reaction—slightly alkaline or moderately alkaline

Gosport Series

Typical Pedon

Gosport silt loam, 25 to 45 percent slopes, in an area of oak/hickory timber on an upland side slope; Webster County, Iowa; 2,400 feet west and 400 feet south of the northeast corner of sec. 12, T. 87 N., R. 28 W.; USGS Lehigh, Iowa, topographic quadrangle; lat. 42 degrees 22 minutes 03 seconds N. and long. 94 degrees 03 minutes 23 seconds W., NAD 83:

A—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; many very fine and fine roots; about 1 percent rock fragments; slightly acid; abrupt smooth boundary.

E—6 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; very weak thin platy structure parting to weak fine subangular blocky; friable; very few very fine and fine roots; common distinct light gray (10YR 7/1) silt coatings on faces of peds; few fine and medium prominent yellowish brown (10YR 5/8) iron concretions; about 1 percent rock fragments; strongly acid; clear smooth boundary.

Bw1—12 to 24 inches; light olive brown (2.5Y 5/4) silty clay; moderate fine and medium angular and subangular blocky structure; friable; very few very fine and fine roots; few distinct light olive brown (2.5Y 5/3) clay films on faces of peds; common fine to coarse prominent yellowish brown (10YR 5/8) iron concretions; about 1 percent rock fragments; strongly acid; gradual smooth boundary.

Bw2—24 to 37 inches; light olive brown (2.5Y 5/4) silty clay; moderate fine and medium angular and subangular blocky structure; friable; few distinct light olive brown (2.5Y 5/3) clay films on faces of peds; common fine to coarse prominent yellowish brown (10YR 5/8) iron concretions; few medium prominent gray (5Y 5/1) redoximorphic depletions; about 1 percent rock fragments; strongly acid; abrupt wavy boundary.

Cr—37 to 65 inches; light olive brown (2.5Y 5/4) silty clay loam; massive but breaks into weak thin plates inherited from the shale bedrock; friable; common medium and coarse prominent yellowish brown (10YR 5/8) and few fine prominent yellowish red (5YR 4/6) iron concretions; common medium prominent gray (5Y 5/1) redoximorphic depletions; about 10 percent rock fragments; strongly acid; abrupt wavy boundary.

R—65 inches; olive gray (5Y 5/2) and dark gray (5Y 4/1) shale bedrock.

Range in Characteristics

Depth to material derived mainly from shale: Typically less than 15 inches

Other features: In cultivated areas, the E horizon is partly or wholly mixed with the Ap horizon.

Ap or A horizon:
- Hue—10YR
- Value—3 or 4
- Chroma—1 or 2
- Texture—silt loam
- Reaction—slightly acid

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

Bw horizon:
- Hue—10YR, 2.5Y, or 5Y
- Value—5 or 6
- Chroma—2 to 4
- Texture—silty clay or clay
- Reaction—extremely acid to strongly acid

Cr horizon:
- Hue—7.5YR to 5Y or N
- Value—4 to 6
- Chroma—0 to 8

Texture—silty clay loam, silty clay, or clay
Reaction—extremely acid to strongly acid

Guckeen Series

Typical Pedon

Guckeen silty clay loam, 1 to 3 percent slopes, in a cultivated field on an upland rise; Webster County, Iowa; 164 feet west and 164 feet north of the southeast corner of sec. 20, T. 86 N., R. 28 W.; USGS Lanyon, Iowa, topographic quadrangle; lat. 42 degrees 14 minutes 22 seconds N. and long. 94 degrees 07 minutes 33 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A—7 to 17 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bg1—17 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay; moderate fine and medium subangular blocky structure; firm; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bg2—23 to 30 inches; grayish brown (2.5Y 4/2) silty clay; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; few distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine prominent black (10YR 2/1) iron-manganese concretions; common fine prominent olive brown (2.5Y 5/6) redoximorphic concentrations; slightly acid; clear smooth boundary.

Bg3—30 to 37 inches; grayish brown (2.5Y 4/2) silty clay loam; moderate fine prismatic structure parting to weak medium subangular blocky; firm; few fine prominent black (10YR 2/1) iron-manganese concretions; common fine and medium prominent olive brown (2.5Y 5/6) redoximorphic concentrations; slightly acid; abrupt smooth boundary.

2C1—37 to 59 inches; light olive brown (2.5Y 5/4) clay loam; massive; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; few fine prominent light gray (10YR 7/2) masses of lime; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; about 2 percent pebbles; very slightly effervescent; slightly alkaline; gradual smooth boundary.

2C2—59 to 80 inches; light olive brown (2.5Y 5/4) loam; massive; friable; few fine prominent light gray (10YR 7/2) masses of lime; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; about 4 percent pebbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Depth to carbonates: 18 to 44 inches
Thickness of clayey lacustrine material: 20 to 40 inches

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

Texture—silty clay loam
Reaction—moderately acid to neutral

Bg or Bw horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—2 or 3
Texture—silty clay loam or silty clay
Reaction—moderately acid to neutral

2C horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Hanlon Series

Typical Pedon

Hanlon fine sandy loam, 0 to 2 percent slopes, in a cultivated field on a flood plain; Webster County, Iowa; 145 feet west and 145 feet north of the southeast corner of sec. 7, T. 89 N., R. 29 W.; USGS Clare, Iowa, topographic quadrangle; lat. 42 degrees 33 minutes 57 seconds N. and long. 94 degrees 20 minutes 49 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common very fine and fine roots; neutral; abrupt smooth boundary.
A1—9 to 29 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; neutral; gradual smooth boundary.
A2—29 to 51 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; common very fine and fine roots; neutral; gradual smooth boundary.
Bw—51 to 70 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; common very fine roots; few fine distinct brown (7.5YR 5/4) redoximorphic concentrations; neutral; clear smooth boundary.
Cg—70 to 80 inches; dark grayish brown (10YR 4/2) sandy loam; massive; very friable; common fine and medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 3 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 40 to 71 inches
Depth to carbonates: More than 48 inches

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

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

Cg horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 or 2
Texture—sandy loam, loam, loamy sand, or sand
Reaction—neutral or slightly alkaline

Harps Series

Typical Pedon

Harps clay loam, 0 to 2 percent slopes, in a cultivated field on the rim of a depression; Webster County, Iowa; 2,180 feet north and 225 feet west of the southeast corner of sec. 23, T. 89 N., R. 27 W.; USGS Eagle Grove SW, Iowa, topographic quadrangle; lat. 42 degrees 30 minutes 26 seconds N. and long. 93 degrees 59 minutes 31 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) clay loam, dark gray (5Y 4/1) dry; moderate fine granular structure; friable; about 5 percent rock fragments; violently effervescent; moderately alkaline; abrupt smooth boundary.

Ak1—8 to 12 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; about 5 percent rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.

Ak2—12 to 16 inches; very dark gray clay loam (N 3/) with about 20 percent dark gray (5Y 4/1) clay loam, gray (10YR 5/1) dry; weak fine and very fine subangular blocky structure; friable; common medium prominent light gray (10YR 7/2) masses of calcium carbonate; about 3 percent rock fragments; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg1—16 to 26 inches; mixed light olive gray (5Y 6/2) and gray (5Y 5/1) loam; weak fine subangular blocky structure; very friable; few very dark gray (10YR 3/1) krotovinas; many fine and medium distinct light gray (10YR 7/2) masses of calcium carbonate; common fine prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; about 3 percent rock fragments; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg2—26 to 34 inches; mixed olive gray (5Y 5/2) and gray (5Y 5/1) loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; a 1-inch very dark gray (10YR 3/1) krotovina; many fine and medium prominent light gray (10YR 7/1) masses of calcium carbonate; many fine prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; about 3 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bkg3—34 to 42 inches; mixed olive gray (5Y 5/2) and gray (5Y 5/1) loam; weak medium prismatic structure parting to very weak medium subangular blocky; friable; few dark gray (5Y 4/1) and very dark gray (N 3/) coatings on faces of peds; a 1-inch very dark gray (N 3/) krotovina; common medium prominent light gray (10YR 7/1) masses of calcium carbonate; many fine prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; about 5 percent rock fragments; strongly effervescent; moderately alkaline; diffuse smooth boundary.

Bkg4—42 to 63 inches; mixed gray (5Y 5/1) loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; common prominent strong brown (7.5YR 5/6) iron coatings on faces of peds; many fine prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; few medium prominent light gray (10YR 7/1) masses of calcium carbonate; about 5 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.
BCg—63 to 80 inches; gray (5Y 4/1) loam; weak coarse prismatic structure; friable; common prominent strong brown (7.5YR 5/6) iron coatings on faces of peds; common medium prominent red (2.5YR 4/6) masses of iron; few fine prominent light gray (10YR 7/2) masses of calcium carbonate; about 7 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Carbonates: Throughout the profile

Ap or Ak horizon:
Hue—10YR or N
Value—2 or 3
Chroma—0 or 1
Texture—loam or clay loam
Reaction—moderately alkaline or strongly alkaline

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

BCg or Cg horizon (if it occurs):
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam, fine sandy loam, clay loam, or sandy loam
Reaction—moderately alkaline or strongly alkaline

Havelock Series

Typical Pedon

Havelock clay loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; Webster County, Iowa; 880 feet west and 50 feet north of the southeast corner of sec. 36, T. 89 N., R. 29 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 33 minutes 30 seconds N. and long. 94 degrees 12 minutes 37 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) clay loam, very dark gray (N 3/) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; strongly effervescent; slightly alkaline; abrupt smooth boundary.
A1—7 to 21 inches; black (N 2/) clay loam, very dark gray (N 3/) dry; moderate fine granular structure; friable; thin (about 1 inch thick), stratified grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) ash layers at 12 inches (30 cm) and 18 inches (46 cm); few fine and medium yellowish brown (10YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; gradual smooth boundary.

A2—21 to 35 inches; black (N 2/) clay loam, very dark gray (N 3/) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few prominent light gray (10YR 7/2) masses of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.
A3—35 to 45 inches; very dark gray (5Y 3/1) clay loam, dark gray (5Y 4/1) dry; weak fine and medium subangular blocky structure; friable; few fine and medium prominent light gray (10YR 7/1) masses of calcium carbonate; slightly effervescent; moderately alkaline; clear smooth boundary.
Cg1—45 to 56 inches; very dark gray (5Y 4/1) clay loam; massive; friable; few fine prominent light gray (10YR 7/1) masses of calcium carbonate; few fine snail-shell fragments; slightly effervescent; moderately alkaline; abrupt wavy boundary.
Cg2—56 to 65 inches; dark gray (5Y 4/1) sandy loam; massive; very friable; about 5 percent rock fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.
Cg3—65 to 80 inches; light olive brown (2.5Y 5/4) sandy loam; massive; very friable; common fine distinct olive gray (5Y 5/2) redoximorphic depletions; about 5 percent rock fragments; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: More than 36 inches
Other features: Some pedons have an AC or Bg horizon.

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

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

Hawick Series

Typical Pedon

Hawick coarse sandy loam, 9 to 14 percent slopes, in a cultivated field in the uplands; Webster County, Iowa; 2,300 feet west and 2,400 feet south of the northeast corner of sec. 27, T. 89 N., R. 29 W.; USGS Moorland, Iowa, topographic quadrangle; lat. 42 degrees 29 minutes 42 seconds N. and long. 94 degrees 15 minutes 20 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) coarse sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine roots; about 12 percent rock fragments; slightly acid; abrupt smooth boundary.
Bw—9 to 16 inches; brown (7.5YR 4/4) loamy coarse sand; weak very fine subangular blocky structure; very friable; about 9 percent gravel; slightly acid; abrupt wavy boundary.

BC—16 to 20 inches; brown (7.5YR 5/4) gravelly loamy coarse sand; weak very fine subangular blocky structure; very friable; about 30 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.
C—20 to 80 inches; olive brown (2.5Y 4/3) gravelly coarse sand; single grain; loose; about 33 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 0 to 30 inches
Content of gravel: 5 to 35 percent

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

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

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

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

Jacwin Series

Typical Pedon

Jacwin silty clay loam, 0 to 2 percent slopes, in a bluegrass field on a high stream terrace; Webster County, Iowa; 2,300 feet east and 875 feet south of the northwest corner of sec. 18, T. 89 N., R. 28 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 31 minutes 37 seconds N. and long. 94 degrees 11 minutes 56 seconds W., NAD 83:

A1—0 to 13 inches; black (N 2/) silty clay loam, black (10YR 2/1) dry; moderate fine and medium subangular blocky structure parting to moderate medium granular; friable; common very fine and fine roots; neutral; gradual smooth boundary.

A2—13 to 19 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; friable; few very fine and fine roots; slightly acid; clear smooth boundary.

AB—19 to 24 inches; mixed very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) silty clay loam; moderate fine and medium subangular blocky structure; friable; few very fine and fine roots; slightly acid; clear smooth boundary.

Bw1—24 to 29 inches; light olive brown (2.5Y 5/3) loam; moderate fine and medium angular blocky and subangular blocky structure; friable; common fine distinct dark gray (2.5Y 4/1) organic coatings on faces of peds; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; clear smooth boundary.

Bw2—29 to 33 inches; light olive brown (2.5Y 5/3) loam; moderate fine and medium subangular blocky structure; friable; common fine and medium prominent yellowish brown (10YR 5/6 and 5/8) redoximorphic concentrations; neutral; abrupt wavy boundary.

2Bkg1—33 to 44 inches; gray (5Y 6/1 and 2.5Y 6/1) silty clay; moderate fine prismatic structure parting to moderate medium angular blocky; firm; few fine and medium white (10YR 8/1) masses of calcium carbonate; common medium prominent yellowish red (5YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; abrupt wavy boundary.

2Bkg2—44 to 52 inches; gray (5Y 6/1) silty clay; moderate medium prismatic structure parting to moderate medium and coarse angular blocky; firm; few fine and medium white (10YR 8/1) masses of calcium carbonate; many medium and coarse prominent dark reddish brown (2.5YR 3/4) and strong brown (7.5YR 5/8) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear wavy boundary.

2Cg—52 to 75 inches; gray (5Y 6/1) and light olive brown (2.5Y 5/3) silty clay; massive; firm; few fine white (10YR 8/1) masses of calcium carbonate; many medium and coarse prominent light reddish brown (2.5YR 6/3) and light yellowish brown (10YR 6/4) redoximorphic concentrations; slightly effervescent; slightly alkaline; abrupt wavy boundary.

2Cr—75 to 80 inches; gray (5Y 6/1) and light olive brown (2.5Y 5/3) silty clay residuum derived from calcareous shale and bedrock; common medium prominent light reddish brown (2.5YR 6/3) redoximorphic concentrations.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Depth to carbonates: 15 to 36 inches
Depth to residuum derived from shale: 30 to 40 inches

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

AB horizon (if it occurs):
Hue—10YR, 2.5Y, or N
Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam or loam
Reaction—slightly acid or neutral

Bw 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

2Bkg or 2BCkg:
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 derived from shale
Reaction—slightly alkaline or moderately alkaline

Joliet Series

Typical Pedon

Joliet silt loam, on a slope of 1 percent in an area of grassland prairie; Will County, Illinois; 680 feet south and 1,484 feet east of the northwest corner of sec. 33, T. 34 N., R. 9 E.; USGS Channahon, Illinois, topographic quadrangle; lat. 41 degrees 23 minutes 17 seconds N. and long. 88 degrees 13 minutes 03 seconds W., NAD 83:

A1—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; friable; common very fine to medium roots; about 1 percent rock fragments; slightly alkaline; gradual wavy boundary.
A2—7 to 12 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; friable; common very fine to medium roots; about 2 percent rock fragments; moderately alkaline; clear smooth boundary.
A3—12 to 15 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; about 5 percent rock fragments; moderately alkaline; abrupt wavy boundary.
Bg—15 to 19 inches; dark gray (2.5Y 4/1) silty clay loam; moderate medium subangular blocky structure; firm; common fine prominent yellowish brown (10YR 5/6) masses of iron in the matrix; few very fine roots; about 5 percent rock fragments; moderately alkaline; abrupt smooth boundary.
2R—19 inches; unweathered limestone bedrock; strongly effervescent.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to bedrock: 10 to 20 inches

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

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or N

Value—3 to 5
Chroma—0 to 2
Texture—loam, clay loam, or silty clay loam
Reaction—slightly acid to moderately alkaline

Kamrar Series

Typical Pedon

Kamrar silty clay loam, 2 to 5 percent slopes, in a cultivated field; Webster County, Iowa; 2,110 feet west and 1,187 feet north of the southeast corner of sec. 12, T. 86 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 16 minutes 16 seconds N. and long. 93 degrees 56 minutes 23 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; moderately acid; abrupt smooth boundary.

A—7 to 15 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; gradual smooth boundary.

Bw1—15 to 21 inches; brown (10YR 4/3) silty clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; firm; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bw2—21 to 32 inches; brown (10YR 4/3) silty clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; firm; common distinct dark brown (10YR 3/3) organic coatings on faces of peds; few fine prominent black (10YR 2/1) iron-manganese concretions; about 1 percent pebbles in the lower part of the horizon; neutral; abrupt wavy boundary.

2Bk1—32 to 42 inches; yellowish brown (10YR 5/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark brown (10YR 3/3) organic coatings on faces of peds; few fine prominent black (10YR 2/1) iron-manganese concretions; common fine and medium prominent light gray (10YR 7/2) threads and masses of calcium carbonate; common fine distinct brown (10YR 5/6) redoximorphic concentrations; about 3 percent pebbles; slightly effervescent; slightly alkaline; gradual smooth boundary.

2Bk2—42 to 54 inches; yellowish brown (10YR 5/4) clay loam; weak medium prismatic structure; firm; common fine prominent black (10YR 2/1) iron-manganese concretions; common fine and medium prominent light gray (10YR 7/2) threads and masses of calcium carbonate; common fine distinct strong brown (10YR 5/6) redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; about 3 percent pebbles; strongly effervescent; slightly alkaline; clear smooth boundary.

2C—54 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; few medium prominent light gray (10YR 7/2) masses of calcium carbonate; few fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; about 4 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 24 to 40 inches

Thickness of the mollic epipedon: 10 to 20 inches
Thickness of lacustrine sediments: 24 to 40 inches

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

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silty clay loam, clay loam, or silty clay
Reaction—moderately acid to neutral

2Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

2C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Kanaranzi Series

Typical Pedon

Kanaranzi silt loam, on a slope of 1 percent in a cultivated field; Nobles County, Minnesota; 200 feet south and 200 feet east of the northwest corner of sec. 5, T. 103 N., R. 43 W.; USGS Kenneth, Minnesota, topographic quadrangle; lat. 43 degrees 45 minutes 39 seconds N. and long. 96 degrees 01 minute 57 seconds W., NAD 83:

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

BA—7 to 12 inches; dark brown (10YR 3/3) loam, brown (10YR 4/3) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine prismatic structure parting to weak fine and medium subangular blocky; friable; slightly acid; clear wavy boundary.

Bw—12 to 20 inches; brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium prismatic structure; friable; slightly acid in the upper part grading to neutral in the lower part; clear wavy boundary.

2C1—20 to 26 inches; mixed brown (10YR 4/3) and grayish brown (10YR 5/2) gravelly coarse sand; single grain; loose; about 20 percent rock fragments; slightly effervescent; slightly alkaline; clear wavy boundary.

2C2—26 to 50 inches; mixed gray (10YR 5/1) and yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 20 percent rock fragments; strongly effervescent; slightly alkaline; clear smooth boundary.

2C3—50 to 80 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 20 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches
Depth to carbonates: 16 to 28 inches

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

BA horizon:
Hue—10YR
Value—3
Chroma—3 or 4
Texture—loam, silt loam, or clay loam
Reaction—slightly acid or neutral

Bw horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 or 4
Texture—loam, silt loam, or clay loam
Reaction—slightly acid or neutral in the upper part; neutral or slightly alkaline in the lower part

2C horizon:
Hue—10YR
Value—4 to 6
Chroma—1 to 4
Texture—sand, coarse sand, gravelly sand, or gravelly coarse sand
Reaction—slightly alkaline or moderately alkaline

Kandiyohi Series

Typical Pedon

Kandiyohi clay loam, 3 to 6 percent slopes, on a high stream terrace; Webster County, Iowa; 1,600 feet west and 2,000 feet south of the northeast corner of sec. 20, T. 87 N., R. 27 W.; USGS Lehigh, Iowa, topographic quadrangle; lat. 42 degrees 20 minutes 03 seconds N. and long. 94 degrees 00 minutes 57 seconds W., NAD 83:

Ap—0 to 6 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure parting to weak medium granular; friable; common fine and medium roots; slightly acid; abrupt smooth boundary.
A1—6 to 15 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; common fine and medium roots; slightly acid; gradual smooth boundary.
A2—15 to 20 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; neutral; clear smooth boundary.
Bw—20 to 30 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate fine and medium subangular blocky structure; friable; few very fine roots; about 1 percent

rock fragments, predominantly in a 2-inch concentrated stone line at 28 to 30 inches with a 1-inch yellowish red (5YR 4/6) lens of iron accumulation at the base of the stone line; neutral; abrupt wavy boundary.

Bkg—30 to 41 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) clay loam; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; common fine and medium prominent light gray (10YR 7/1) masses of calcium carbonate; about 3 percent rock fragments; strongly effervescent; slightly alkaline; abrupt wavy boundary.

BCg—41 to 50 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/3) clay loam; weak coarse prismatic structure; firm; few coarse faint gray (2.5Y 6/1) redoximorphic depletions; about 5 percent rock fragments; strongly effervescent; slightly alkaline; abrupt wavy boundary.

Cg—50 to 80 inches; mottled grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/3) clay loam; massive; firm; about 8 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 20 inches
Depth to carbonates: 16 to 36 inches

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

Bg or Bw horizon:
- Hue—2.5Y
- Value—4 or 5
- Chroma—2 to 4
- Texture—clay loam or silty clay loam
- Reaction—slightly acid or neutral

Bkg horizon:
- Hue—2.5Y or 5Y
- Value—4 to 6
- Chroma—2 to 4
- Texture—clay loam or clay
- Reaction—slightly alkaline or moderately alkaline

BCg or Cg horizon:
- Hue—2.5Y or 5Y
- Value—4 to 6
- Chroma—1 to 3
- Texture—clay loam or clay
- Reaction—slightly alkaline or moderately alkaline

Kilkenny Series

Typical Pedon

Kilkenny silt loam, 2 to 5 percent slopes, in a timbered area in the uplands; Webster County, Iowa; 1,860 feet west and 1,660 feet north of the southeast corner of sec. 18, T. 86 N., R. 27 W.; USGS Lehigh, Iowa, topographic quadrangle; lat. 42 degrees 15 minutes 26 seconds N. and long. 94 degrees 02 minutes 03 seconds W., NAD 83:

A—0 to 6 inches; very dark brown (10YR 2/2) silt loam with mixings of brown (10YR 5/3) in the lower part, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common very fine and fine roots; moderately acid; abrupt smooth boundary.

E—6 to 14 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; common fine and very fine roots; moderately acid; abrupt smooth boundary.

Bt1—14 to 18 inches; olive brown (2.5Y 4/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; common fine and very fine roots; many distinct light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt2—18 to 23 inches; olive brown (2.5Y 4/3) clay; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; common distinct light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt3—23 to 30 inches; olive brown (2.5Y 4/3) clay; moderate fine prismatic structure parting to moderate fine and medium angular blocky; firm; few very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; common distinct light gray (10YR 7/1) silt coatings on faces of peds; neutral; gradual smooth boundary.

Bt4—30 to 42 inches; brown (10YR 4/3) clay loam; thin lens of loamy sand at 41 to 42 inches; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine prominent black (10YR 2/1) manganese concretions; common fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; common medium faint grayish brown (2.5Y 5/2) redoximorphic depletions; neutral; abrupt smooth boundary.

Bt5—42 to 57 inches; brown (10YR 5/3) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; few fine prominent black (10YR 2/1) manganese concretions; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 2 percent rock fragments; neutral; gradual smooth boundary.

2BC—57 to 68 inches; yellowish brown (10YR 5/4) clay loam; weak medium prismatic structure; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; few fine prominent black (10YR 2/1) manganese concretions; few medium distinct strong brown (7.5YR 5/6) redoximorphic concentrations; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; about 3 percent rock fragments; slightly alkaline; abrupt wavy boundary.

2C—68 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; few prominent yellowish red (5YR 4/6) iron masses; few fine prominent black (10YR 2/1) manganese concretions; few medium distinct strong brown (7.5YR 5/6) redoximorphic concentrations; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; about 3 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 60 inches

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

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

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

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

2BC or 2C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 5
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Klossner Series

Typical Pedon

Klossner muck, 0 to 2 percent slopes, in a cultivated field in an upland depression; Webster County, Iowa; 1,600 feet south and 1,500 feet west of the northeast corner of sec. 34, T. 86 N., R. 30 W.; USGS Paton, Iowa, topographic quadrangle; lat. 42 degrees 13 minutes 18 seconds N. and long. 94 degrees 19 minutes 34 seconds W., NAD 83:

Oap—0 to 8 inches; black (N 2/) muck, black (10YR 2/1) dry; weak fine granular structure; friable; about 10 percent fiber, 1 percent rubbed; common very fine and fine roots; neutral; abrupt smooth boundary.
Oa—8 to 26 inches; black (N 2/) muck, black (10YR 2/1) dry; weak fine granular structure; friable; common very fine and fine roots; about 20 percent fiber, 3 percent rubbed; neutral; abrupt smooth boundary.
2A1—26 to 34 inches; black (N 2/) mucky silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; friable; few very fine and fine roots; neutral; gradual smooth boundary.
2A2—34 to 47 inches; black (N 2/) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.
2Cg1—47 to 58 inches; olive gray (5Y 4/2) clay loam; massive; friable; few fine prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; about 2 percent rock fragments; neutral; abrupt smooth boundary.
2Cg2—58 to 63 inches; gray (5Y 5/1) sandy loam; massive; friable; few fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; about 1 percent rock fragments; slightly effervescent; slightly alkaline; abrupt wavy boundary.
2Cg3—63 to 80 inches; dark gray (5Y 4/1) loam; massive; firm; few medium distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; about 7 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the organic material: 16 to 50 inches

Oa and Oap horizons:
Hue—10YR, 5Y, or N
Value—2 or 3
Chroma—0 to 2
Texture—muck
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, silty clay loam, or clay loam or the mucky analogs of these textures
Reaction—moderately acid to slightly alkaline

2Cg horizon:
Hue—10YR to 5GY or N
Value—2 to 7
Chroma—0 to 2
Texture—loam, clay loam, silt loam, silty clay loam, or sandy loam or the gravelly analogs of these textures
Reaction—slightly acid to moderately alkaline

Knoke Series

Typical Pedon

Knoke mucky silt loam, 0 to 1 percent slopes, in a cultivated field; Calhoun County, Iowa; 1,440 feet north and 50 feet west of the southeast corner of sec. 3, T. 88 N., R. 33 W.; USGS Rockwell City, Iowa, topographic quadrangle; lat. 42 degrees 27 minutes 38 seconds N. and long. 94 degrees 40 minutes 11 seconds W., NAD 83:

Ap—0 to 8 inches; black (5Y 2/1) mucky silt loam, dark gray (10YR 4/1) dry; weak medium platy structure parting to weak fine subangular blocky; friable; many snail shells; violently effervescent; moderately alkaline; abrupt smooth boundary.

A1—8 to 13 inches; very dark gray (5Y 3/1) mucky silty clay loam, gray (10YR 5/1) dry; weak medium platy structure; friable; thin brown (7.5YR 5/4) coatings in fine continuous vertical tubular pores; many snail shells; violently effervescent; moderately alkaline; abrupt smooth boundary.

A2—13 to 18 inches; black (5Y 2/1) mucky silty clay loam, dark gray (10YR 4/1) dry; weak medium platy structure; friable; many snail shells; thin brown (7.5YR 5/4) coatings in fine continuous vertical tubular pores; violently effervescent; moderately alkaline; clear smooth boundary.

A3—18 to 33 inches; black (N 2/) silty clay loam, dark gray (10YR 4/1) dry; weak very fine and fine subangular blocky structure; friable; few olive brown (2.5Y 4/4) (dry) coatings in fine continuous vertical tubular pores; slightly effervescent; slightly alkaline; gradual smooth boundary.

A4—33 to 40 inches; black (N 2/) silty clay loam, dark gray (10YR 4/1) dry; weak fine angular and subangular blocky structure; friable; few olive brown (2.5Y 4/4) (dry) coatings in fine discontinuous vertical tubular pores; strongly effervescent; slightly alkaline; clear smooth boundary.

A5—40 to 46 inches; black (N 2/) silty clay loam, gray (10YR 5/1) dry; weak fine prismatic structure parting to weak fine subangular blocky; friable; common medium prominent olive brown (2.5Y 4/4) iron concentrations; strongly effervescent; slightly alkaline; clear smooth boundary.

BCg—46 to 54 inches; gray (5Y 5/1), very dark gray (5Y 3/1), and dark gray (2.5Y 4/1) silty clay loam; weak fine prismatic structure; friable; strongly effervescent; moderately alkaline; gradual smooth boundary.
Cg—54 to 63 inches; gray (5Y 5/1) silty clay loam; massive; friable; common soft lime accumulations; many medium prominent dark yellowish brown (10YR 4/4) iron concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to more than 60 inches
Other features: Most pedons contain fragments of snail shells or clam shells.

Ap or A horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2 or 3
Chroma—0 to 2
Texture—mucky silt loam, mucky silty clay loam, or silty clay loam; silty clay loam, clay loam, or silty clay below a depth of 20 inches in the A horizon
Reaction—slightly alkaline or moderately alkaline

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam, clay loam, or silty clay
Reaction—slightly alkaline or moderately alkaline

BCg horizon:
Hue—2.5Y, 5Y, or N
Value—2 to 5
Chroma—0 or 1
Texture—silty clay loam, clay loam, or silty clay
Reaction—slightly alkaline or moderately alkaline

Cg horizon:
Hue—2.5Y, 5Y, or 5G
Value—3 to 6
Chroma—1 or 2
Texture—silty clay loam; thin strata of loam, silt loam, or clay loam in some pedons
Reaction—slightly alkaline or moderately alkaline

Lanyon Series

Typical Pedon

Lanyon silty clay, depressional, 0 to 1 percent slopes, in a depression in a cultivated field; Webster County, Iowa; 15 feet west and 1,120 feet south of the northeast corner of sec. 31, T. 86 N., R. 28 W.; USGS Lanyon, Iowa, topographic quadrangle; lat. 42 degrees 13 minutes 22 seconds N. and long. 94 degrees 08 minutes 44 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) silty clay, very dark gray (10YR 3/1) dry; weak and moderate fine granular and very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.
A—7 to 13 inches; black (5Y 2/1) silty clay, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; firm; few fine faint very dark grayish brown (2.5Y

3/2) redoximorphic concentrations; few fine distinct dark gray (N 4/) redoximorphic depletions; slightly alkaline; abrupt smooth boundary.

BA—13 to 16 inches; very dark gray (5Y 3/1) and dark grayish brown (2.5Y 4/2) silty clay, olive gray (5Y 5/2) dry; weak medium prismatic structure parting to weak fine subangular blocky; firm; many very fine snail-shell fragments; common medium distinct olive (5Y 4/3) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.

Bg1—16 to 20 inches; olive gray (5Y 4/2), very dark gray (5Y 3/1), and dark gray (5Y 4/1) silty clay; weak medium prismatic structure parting to weak fine subangular blocky; firm; common snail-shell fragments; few coarse distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bg2—20 to 25 inches; dark gray (5Y 4/1) and olive gray (5Y 4/2) silty clay; weak fine and medium prismatic structure parting to weak fine subangular blocky; firm; few medium prominent brown (7.5YR 4/4) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bg3—25 to 46 inches; dark gray (5Y 4/1) silty clay; weak fine and medium prismatic structure parting to weak fine subangular blocky; firm; few fine prominent black (10YR 2/1) iron-manganese concretions; few coarse prominent white (10YR 8/1) masses of calcium carbonate; common snail-shell fragments; common fine distinct olive (5Y 4/3) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bg4—46 to 52 inches; dark gray (5Y 4/1) silty clay loam; weak fine and medium prismatic structure; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; few medium prominent gray (10YR 6/1) calcium carbonate concretions; common medium prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Bg5—52 to 60 inches; dark gray (5Y 4/1) clay loam; weak medium prismatic structure; friable; few thin strata of sand; common fine prominent black (10YR 2/1) iron-manganese concretions; many medium prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; about 5 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

2BCg—60 to 80 inches; dark gray (5Y 4/1) loam; weak coarse prismatic structure; firm; many prominent red (2.5YR 4/6) iron coatings and common black (10YR 2/1) iron-manganese coatings on faces of peds; common medium prominent reddish brown (5YR 5/4) redoximorphic concentrations; about 6 percent rock fragments; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 20 inches
Thickness of the mollic epipedon: 8 to 20 inches

Ap or A horizon:
Hue—10YR to 5Y or N
Value—2
Chroma—0 or 1
Texture—silty clay or silty clay loam
Reaction—neutral or slightly alkaline

AB or BA horizon (if it occurs):
Hue—10YR to 5Y
Value—3 or 4
Chroma—1 or 2

Texture—silty clay or silty clay loam
Reaction—slightly alkaline or moderately alkaline

Bg horizon:
Hue—2.5Y or 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silty clay or silty clay loam; clay loam included in the lower part
Reaction—slightly alkaline or moderately alkaline

2BCg or 2Cg horizon:
Hue—5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Lawson Series

Typical Pedon

Lawson silt loam, on a slope of 1 percent, in an uncultivated field; Iowa County, Wisconsin; 1,000 feet east and 2,400 feet south of the northwest corner of sec. 17, T. 4 N., R. 3 E.; USGS Mineral Point, Wisconsin, topographic quadrangle; lat. 42 degrees 49 minutes 21 seconds N. and long. 90 degrees 10 minutes 06 seconds W., NAD 83:

A1—0 to 12 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to moderate medium and fine granular; friable; many roots; neutral; clear wavy boundary.
A2—12 to 19 inches; black (10YR 2/1) and very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate medium and fine granular; friable; many roots; neutral; clear wavy boundary.
A3—19 to 30 inches; black (10YR 2/1) and very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; neutral; clear wavy boundary.
C1—30 to 40 inches; very dark gray (10YR 3/1) and black (10YR 2/1) silty clay loam stratified with thin lenses of silt loam and loam; moderate medium angular and subangular blocky structure; firm; neutral; clear wavy boundary.
C2—40 to 60 inches; dark grayish brown (10YR 4/2) silt loam interlayered with thin lenses of loam and sandy loam; massive with a few thin coarse textured strata; friable; common fine prominent yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; neutral.

Range in Characteristics:

Thickness of the mollic epipedon: 24 to 36 inches

Ap or 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—silt loam or silty clay loam or stratified with silt loam, silty clay loam, loam, and sandy loam; thin strata of coarser textures are common
Reaction—slightly acid to slightly alkaline

Le Sueur Series

Typical Pedon

Le Sueur loam, 1 to 3 percent slopes, in a timbered wildlife area on an upland flat; Webster County, Iowa; 800 feet east and 300 feet south of the northwest corner of sec. 10, T. 87 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 22 minutes 03 seconds N. and long. 93 degrees 59 minutes 16 seconds W., NAD 83:

A—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and medium granular structure; friable; common fine and medium roots; slightly acid; abrupt wavy boundary.

E—10 to 13 inches; very dark grayish brown (10YR 3/2) loam with some mixing (about 35 percent) of dark grayish brown (2.5Y 4/2) in the lower part, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak fine granular; friable; few fine and medium roots; slightly acid; abrupt smooth boundary.

Btg1—13 to 20 inches; dark grayish brown (2.5Y 4/2) loam; moderate fine and medium subangular blocky structure; friable; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg2—20 to 27 inches; grayish brown (2.5Y 5/2) clay loam; weak coarse prismatic structure parting to moderate fine and medium angular and subangular blocky; friable; very few fine roots; common distinct very dark grayish brown (2.5Y 3/2) clay films on faces of peds and along surfaces of root channels; many very fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid; gradual smooth boundary.

Btg3—27 to 35 inches; light olive brown (2.5Y 5/3) clay loam; weak coarse prismatic structure parting to moderate fine and medium angular and subangular blocky; friable; common distinct very dark grayish brown (2.5Y 3/2) clay films on faces of peds and along surfaces of root channels; common distinct black (10YR 2/1) manganese concretions; few fine prominent strong brown (7.5YR 5/6 and 5/8) redoximorphic concentrations; about 1 percent rock fragments; neutral; clear smooth boundary.

Btg4—35 to 48 inches; light olive brown (2.5Y 5/3) clay loam; very weak coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; common distinct very dark grayish brown (2.5Y 3/2) clay films on faces of peds and along surfaces of root channels; common distinct black (10YR 2/1) manganese concretions; common medium prominent strong brown (7.5YR 5/8) and few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; common coarse faint light brownish gray (2.5Y 6/2) redoximorphic depletions; about 1 percent rock fragments; neutral; abrupt wavy boundary.

BC—48 to 68 inches; light olive brown (2.5Y 5/3) loam; very weak coarse prismatic structure parting to weak fine and medium subangular blocky; friable; few distinct very dark grayish brown (2.5Y 3/2) clay films along surfaces of root channels; common distinct black (10YR 2/1) manganese concretions; common distinct very pale brown (10YR 8/3) calcium carbonate coatings and threads on faces of peds; many fine and medium prominent yellowish brown (10YR 5/6) and common fine and medium prominent strong brown (7.5YR 5/6 and 5/8) redoximorphic

concentrations; about 1 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—68 to 80 inches; light olive brown (2.5Y 5/3) loam; massive; friable; common distinct black (10YR 2/1) manganese concretions; few distinct very pale brown (10YR 8/3) calcium carbonate masses; many fine and medium prominent yellowish brown (10YR 5/6) and common fine and medium prominent strong brown (7.5YR 5/6 and 5/8) redoximorphic concentrations; about 3 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 18 inches
Depth to carbonates: 22 to 55 inches

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

E horizon (if it occurs):
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—2 or 3
Texture—loam or silt loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—10YR or 2.5Y in the upper part; 2.5Y in the lower part
Value—3 to 5 in the upper part; 4 or 5 in the lower part
Chroma—2 or 3 in the upper part; 2 to 4 in the lower part
Texture—clay loam or loam
Reaction—strongly acid to slightly acid in the upper part; strongly acid to neutral in the lower part

BC and C horizons:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Lerdal Series

Typical Pedon

Lerdal silt loam, 1 to 3 percent slopes, in a timbered pasture on an upland flat; Webster County, Iowa; 236 feet east and 1,440 feet north of the southwest corner of sec. 18, T. 87 N., R. 27 W.; USGS Lehigh, Iowa, topographic quadrangle; lat. 42 degrees 15 minutes 26 seconds N. and long. 94 degrees 02 minutes 49 seconds W., NAD 83:

A—0 to 5 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common very fine and fine roots; moderately acid; abrupt smooth boundary.

E—5 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; common fine and very fine roots; few distinct dark gray (10YR 4/1) organic coatings on faces of peds; moderately acid; abrupt smooth boundary.

Btg1—11 to 15 inches; dark grayish brown (2.5Y 4/2) silty clay loam; moderate fine and medium subangular blocky structure; friable; common fine and very fine roots; common distinct very dark grayish brown (2.5Y 3/2) organic coatings on faces of peds; many distinct light gray (10YR 7/1) silt coatings on faces of peds; moderately acid; clear smooth boundary.

Btg2—15 to 23 inches; dark grayish brown (2.5Y 4/2) clay; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; common very fine roots; many distinct very dark gray (10YR 3/1) clay films on faces of peds; moderately acid; clear smooth boundary.

Btg3—23 to 33 inches; dark grayish brown (2.5Y 4/2) clay; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; common fine and medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; moderately acid; clear smooth boundary.

Btg4—33 to 41 inches; dark grayish brown (2.5Y 4/2) clay; weak fine prismatic structure parting to weak medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; neutral; clear smooth boundary.

Btg5—41 to 51 inches; grayish brown (2.5Y 5/2) silty clay; weak medium prismatic structure parting to weak medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds and on surfaces along root channels; few fine prominent strong brown (7.5YR 4/6) iron concretions; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 1 percent rock fragments; neutral; abrupt wavy boundary.

Bt—51 to 59 inches; yellowish brown (2.5Y 5/4) clay; weak medium prismatic structure; friable; common distinct very dark gray (10YR 3/1) clay films on faces of peds and on surfaces along root channels; many medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; about 3 percent rock fragments; strongly effervescent; slightly alkaline; gradual smooth boundary.

C—59 to 80 inches; light yellowish brown (2.5Y 6/4) loam; massive; friable; common distinct very dark gray (10YR 3/1) clay films on surfaces along root channels; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; about 5 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 25 to 65 inches

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

E horizon:
- Hue—10YR
- Value—3 to 5
- Chroma—1 or 2
- Texture—silt loam or silty clay loam
- Reaction—moderately acid or slightly acid

Btg or Bt horizon:
Hue—10YR or 2.5Y in the upper part; 2.5Y or 5Y in the lower part
Value—4 or 5
Chroma—1 or 2 in the upper part; 2 to 4 in the lower part
Texture—clay loam, silty clay loam, silty clay, or clay
Reaction—strongly acid or moderately acid in the upper part; moderately acid to slightly alkaline in the lower part

2C horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Lester Series

Typical Pedon

Lester loam, 9 to 14 percent slopes, in an area of timber in the uplands; Webster County, Iowa; 1,600 feet north and 2,080 feet east of the southwest corner of sec. 35, T. 86 N., R. 27 W.; USGS Fraser, Iowa, topographic quadrangle; lat. 42 degrees 12 minutes 50 seconds N. and long. 93 degrees 57 minutes 46 seconds W., NAD 83:

A—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few very fine and fine roots; about 3 percent rock fragments; neutral; abrupt smooth boundary.
E—7 to 12 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 5/2) dry; weak thin platy structure; friable; few fine roots; few distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; about 3 percent rock fragments; neutral; clear smooth boundary.
Bt1—12 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; common distinct strong brown (7.5YR 4/6) clay films on faces of peds; about 3 percent rock fragments; slightly acid; gradual smooth boundary.
Bt2—20 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; friable; common distinct strong brown (7.5YR 4/4) clay films on faces of peds; about 3 percent rock fragments; slightly acid; gradual smooth boundary.
Bt3—32 to 41 inches; brown (10YR 4/3) clay loam; moderate fine prismatic structure parting to weak medium subangular blocky; friable; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; about 4 percent rock fragments; slightly acid; abrupt wavy boundary.
Bk—41 to 54 inches; yellowish brown (10YR 5/4) loam; weak coarse prismatic structure; friable; common fine prominent light gray (10YR 7/2) masses of calcium carbonate; few coarse prominent strong brown (7.5YR 5/8) relict redoximorphic concentrations; about 5 percent rock fragments; strongly effervescent; slightly alkaline; gradual smooth boundary.
C—54 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; few fine distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; about 5 percent rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 54 inches

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

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

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam or clay loam
Reaction—strongly acid to slightly acid in the upper part; moderately acid to neutral in the lower part

Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Luther Series

Typical Pedon

Luther loam, 1 to 3 percent slopes, in a cultivated field in an upland swale; Webster County, Iowa; 1,590 feet north and 2,020 feet east of the southwest corner of sec. 23, T. 88 N., R. 28 W.; USGS Evanston, Iowa, topographic quadrangle; lat. 42 degrees 24 minutes 59 seconds N. and long. 94 degrees 04 minutes 47 seconds W., NAD 83:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; about 2 percent rock fragments; slightly acid; abrupt smooth boundary.

E—5 to 10 inches; dark grayish brown (10YR 4/2) loam, gray (10YR 6/1) dry; weak fine subangular blocky structure parting to weak medium platy; friable; common fine roots; few distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; about 2 percent rock fragments; slightly acid; clear smooth boundary.

Bt1—10 to 14 inches; dark grayish brown (10YR 4/2) clay loam; moderate fine and medium subangular blocky structure; friable; few fine roots; few distinct dark brown

(10YR 3/3) clay films on faces of peds; common distinct light gray (10YR 7/1) silt coatings on faces of peds; about 2 percent rock fragments; slightly acid; clear smooth boundary.

Bt2—14 to 20 inches; dark grayish brown (10YR 4/2) clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; few very fine roots; few distinct dark brown (10YR 3/3) clay films on faces of peds; few distinct light gray (10YR 7/1) silt coatings on faces of peds; few fine faint brown (10YR 5/3) redoximorphic concentrations; about 3 percent rock fragments; slightly acid; clear smooth boundary.

Btg1—20 to 26 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 3 percent rock fragments; slightly acid; clear smooth boundary.

Btg2—26 to 31 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concretions; few fine prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 3 percent rock fragments; moderately acid; clear smooth boundary.

Btg3—31 to 36 inches; grayish brown (2.5Y 5/2) clay loam; moderate medium prismatic structure parting to weak medium subangular blocky; friable; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine prominent black (10YR 2/1 iron and manganese concretions; few fine prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 3 percent gravel; moderately acid; clear smooth boundary.

Btg4—36 to 42 inches; grayish brown (2.5Y 5/2) clay loam; weak medium prismatic structure; friable; few distinct very dark grayish brown (10YR 3/2) clay coatings on faces of peds; few distinct black (10YR 2/1) clay coatings along surfaces of root channels; few fine prominent black (10YR 2/1) iron and manganese concretions; few medium prominent yellowish red (5YR 4/6) iron masses; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 5 percent gravel; neutral; clear smooth boundary.

Btg5—42 to 48 inches; grayish brown (2.5Y 5/2) loam; weak coarse prismatic structure; friable; few distinct black (10YR 2/1) clay films along surfaces of root channels; common fine and medium prominent black (10YR 2/1) iron and manganese concretions; few fine prominent yellowish red (5YR 4/6) iron masses; common fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 5 percent rock fragments; neutral; gradual smooth boundary.

Cg—48 to 80 inches; grayish brown (2.5Y 5/2) loam; massive; friable; few fine and medium prominent black (10YR 2/1) iron and manganese concretions; few fine prominent light gray (10YR 7/2) masses of calcium carbonate; many coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 7 percent rock fragments; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 28 to 60 inches

Ap or A horizon:

Hue—10YR
Value—3 (A horizon); 3 or 4 (Ap horizon)
Chroma—1 or 2
Texture—loam
Reaction—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 or Btg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 or 3
Texture—clay loam
Reaction—strongly acid to neutral

C or Cg horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 8
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Malardi Series

Typical Pedon

Malardi sandy loam, on a convex slope of about 4 percent, in a cultivated field; Wright County, Minnesota; 2,550 feet west and 100 feet north of the southeast corner of sec. 13, T. 121 N., R. 26 W.; USGS Silver Creek, Minnesota, topographic quadrangle; lat. 45 degrees 16 minutes 58 seconds N. and long. 93 degrees 54 minutes 02 seconds W., NAD 83:

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; many fine roots; about 4 percent gravel; slightly acid; abrupt smooth boundary.
Bt1—10 to 15 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; few discontinuous dark brown (10YR 3/3) clay films on faces of peds; common fine roots; about 6 percent gravel; slightly acid; gradual wavy boundary.
2Bt2—15 to 29 inches; brown (10YR 4/3) loamy coarse sand; weak fine subangular blocky structure; very friable; clay bridging between sand grains; few fine roots; about 8 percent gravel; neutral; gradual wavy boundary.
2C—29 to 80 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 16 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 18 inches
Depth to carbonates: 18 to 60 inches

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

Bt horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—2 to 4
Texture—sandy loam, fine sandy loam, coarse sandy loam, or loam
Reaction—moderately acid to neutral

2Bt or 2BC horizon (if it occurs):
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—2 to 6
Texture—loamy sand, loamy coarse sand, or coarse sand or the gravelly analogs of these textures
Reaction—moderately acid to neutral

2C horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—2 to 4
Texture—sand, loamy sand, or coarse sand or the gravelly analogs of these textures
Reaction—slightly alkaline or moderately alkaline

Marna Series

Typical Pedon

Marna silty clay loam, 0 to 2 percent slopes, in a cultivated field on an upland flat; Webster County, Iowa; 912 feet west and 120 feet south of the northeast corner of sec. 26, T. 86 N., R. 28 W.; USGS Boxholm, Iowa, topographic quadrangle; lat. 42 degrees 14 minutes 19 seconds N. and long. 94 degrees 04 minutes 13 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) silty clay loam, black (10YR 2/1) dry; moderate fine and medium granular structure; firm; neutral; abrupt smooth boundary.

A—7 to 18 inches; black (N 2/) silty clay loam, black (10YR 2/1) dry; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; firm; slightly acid; clear smooth boundary.

Bg1—18 to 27 inches; dark gray (5Y 4/1) silty clay; moderate fine prismatic structure parting to moderate fine and medium angular blocky; firm; many black (10YR 2/1) organic coatings on faces of peds; few fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations; slightly acid; clear smooth boundary.

Bg2—27 to 36 inches; olive gray (5Y 4/2) silty clay; moderate fine prismatic structure parting to moderate fine and medium angular blocky; firm; many black (10YR 2/1) organic coatings on faces of peds; few fine shale fragments in the lower part; common fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations; neutral; abrupt wavy boundary.

2Bkg—36 to 45 inches; olive gray (5Y 4/2 and 5/2) clay loam; moderate medium prismatic structure parting to weak fine and medium subangular blocky; firm; common fine and medium white (10YR 8/1) masses of calcium carbonate; common fine prominent yellowish red (5YR 5/8) redoximorphic concentrations; about 3 percent rock fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.

2Cg1—45 to 64 inches; olive gray (5Y 5/2) clay loam; massive; firm; few fine and medium distinct white (10YR 8/1) masses of calcium carbonate; common fine prominent yellowish brown (10YR 5/4) and few fine prominent strong brown

(7.5YR 5/8) redoximorphic concentrations; about 3 percent rock fragments; strongly effervescent; slightly alkaline; clear smooth boundary.

2Cg2—64 to 80 inches; olive gray (5Y 5/2) loam; massive; friable; few fine and medium white (10YR 8/1) masses of calcium carbonate; few medium prominent yellowish red (5YR 4/6) iron concretions; many fine and medium prominent yellowish brown (10YR 5/4) redoximorphic concentrations; about 4 percent rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 26 to 48 inches
Thickness of the mollic epipedon: 16 to 24 inches
Thickness of lacustrine sediments: 24 to 40 inches

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

Bg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay, silty clay loam, or clay loam
Reaction—slightly acid or neutral

2Bkg or 2Cg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Minnetonka Series

Typical Pedon

Minnetonka silty clay loam, 0 to 2 percent slopes, in a bluegrass pasture on an upland flat; Webster County, Iowa; 2,500 feet east and 1,900 feet south of the northwest corner of sec. 18, T. 87 N., R. 27 W.; USGS Lehigh, Iowa, topographic quadrangle; lat. 42 degrees 15 minutes 46 seconds N. and long. 94 degrees 02 minutes 19 seconds W., NAD 83:

A1—0 to 7 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine and fine roots; slightly acid; clear smooth boundary.

A2—7 to 17 inches; very dark gray (10YR 2/1) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; few distinct light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Btg1—17 to 25 inches; very dark gray (5Y 3/1) silty clay; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; firm; common very fine roots; common distinct black (10YR 2/1) clay films on faces of peds; common fine prominent olive brown (2.5Y 4/4) redoximorphic concentrations; slightly acid; gradual smooth boundary.

Btg2—25 to 37 inches; dark gray (5Y 4/1) silty clay; moderate fine prismatic structure parting to strong fine and medium angular blocky; firm; few very fine roots; common distinct very dark gray (10YR 3/1) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concretions; many fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Btg3—37 to 45 inches; olive gray (5Y 5/2) silty clay; moderate fine prismatic structure parting to strong fine and medium angular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; common fine prominent black (10YR 2/1) iron and manganese concretions; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual smooth boundary.

Btg4—45 to 52 inches; olive gray (5Y 5/2) silty clay loam; weak fine prismatic structure; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; common fine prominent black (10YR 2/1) iron and manganese concretions; few fine prominent yellowish red (5YR 4/6) iron concretions; many fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 1 percent rock fragments; neutral; abrupt wavy boundary.

2BCg—52 to 62 inches; olive gray (5Y 5/2) clay loam; massive; firm; few distinct very dark gray (10YR 3/1) clay films on surfaces along root channels; common fine and medium prominent black (10YR 2/1) iron and manganese concretions; many medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 5 percent rock fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.

2C1—62 to 71 inches; grayish brown (2.5Y 5/2) clay loam; massive; firm; few fine prominent black (10YR 2/1) iron and manganese concretions; common fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 5 percent rock fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.

2C2—71 to 80 inches; grayish brown (2.5Y 5/2) loam; massive; firm; few fine distinct yellowish red (5YR 4/6) iron concretions; many medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 5 percent rock fragments; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 26 inches
Depth to carbonates: 28 to 52 inches

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

Btg horizon:
Hue—10YR to 5Y
Value—2 or 3 in the upper part; 4 or 5 in the lower part
Chroma—1 or 2
Texture—silty clay or silty clay loam
Reaction—strongly acid to neutral

2BC and 2C horizons:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2

Texture—loam or clay loam
Reaction—neutral to moderately alkaline

Moingona Series

Typical Pedon

Moingona loam, 5 to 9 percent slopes, on a footslope in a wildlife area; Webster County, Iowa; 2,540 feet south and 280 feet west of the northeast corner of sec. 21, T. 86 N., R. 27 W.; USGS Fraser, Iowa, topographic quadrangle; lat. 42 degrees 14 minutes 46 seconds N. and long. 93 degrees 59 minutes 27 seconds W., NAD 83:

A—0 to 11 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; moderately acid; abrupt smooth boundary.

E—11 to 17 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 6/2) dry; weak thin platy structure; friable; common very fine and fine roots; common distinct very dark brown (10YR 2/2) organic coatings on faces of peds; common prominent light gray (10YR 7/1) (dry) silt coatings on faces of peds; moderately acid; clear smooth boundary.

BE—17 to 24 inches; brown (10YR 4/3) loam; weak fine prismatic structure parting to moderate fine subangular blocky; friable; common fine and very fine roots; many distinct very dark gray (10YR 3/1) organic coatings on faces of peds; many prominent light gray (10YR 7/1) (dry) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—24 to 29 inches; brown (10YR 4/3) clay loam; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; common prominent light gray (10YR 7/1) (dry) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt2—29 to 38 inches; brown (10YR 4/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; few prominent light gray (10YR 7/1) (dry) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt3—38 to 47 inches; yellowish brown (10YR 5/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concretions; few fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; slightly acid; gradual smooth boundary.

Bt4—47 to 56 inches; yellowish brown (10YR 5/4) loam; moderate coarse prismatic structure parting to weak medium subangular blocky; firm; few distinct strong brown (7.5YR 4/6) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concretions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; neutral; clear smooth boundary.

BC—56 to 67 inches; yellowish brown (10YR 5/4) loam with thin strata of sandy loam; weak coarse prismatic structure; firm; few distinct strong brown (7.5YR 4/6) clay films on faces of peds; few fine prominent black (10YR 2/1) iron and manganese concretions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; few fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; neutral; gradual smooth boundary.

C—67 to 80 inches; yellowish brown (10YR 5/4) loam with thin strata of silty clay loam; massive; firm; few distinct strong brown (7.5YR 4/6) clay films along surfaces of root channels; few fine prominent black (10YR 2/1) iron and manganese

concretions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 18 inches

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

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

BE horizon (if it occurs):
Hue—10YR
Value—4
Chroma—3
Texture—loam or sandy loam
Reaction—moderately acid to neutral

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

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

Nicollet Series

Typical Pedon

Nicollet loam, 1 to 3 percent slopes, on a slight upland rise in a cultivated field; Webster County, Iowa; 160 feet north and 1,100 feet west of the southeast corner of sec. 32, T. 90 N., R. 28 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 33 minutes 31 seconds N. and long. 94 degrees 10 minutes 18 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; about 2 percent rock fragments; neutral; abrupt smooth boundary.

A1—7 to 18 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; about 2 percent rock fragments; slightly acid; clear smooth boundary.
A2—18 to 23 inches; very dark grayish brown (10YR 3/2) loam; weak fine and medium subangular blocky structure; friable; common black (10YR 2/1) organic coatings on faces of peds; about 2 percent rock fragments; slightly acid; clear smooth boundary.
Bw—23 to 31 inches; dark grayish brown (2.5Y 4/2) loam; weak fine and medium subangular blocky structure; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; about 2 percent rock fragments; slightly acid; clear smooth boundary.
Bg—31 to 46 inches; grayish brown (2.5Y 5/2) loam; weak fine and medium subangular blocky structure; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; few fine prominent reddish brown (5YR 4/4) masses of iron; few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 2 percent rock fragments; neutral; abrupt wavy boundary.
BCg—46 to 57 inches; light brownish gray (2.5Y 5/2) loam; weak medium subangular blocky structure; friable; few fine prominent light gray (10YR 7/2) masses of calcium carbonate; few fine prominent black (10YR 2/1) iron-manganese concretions; few fine prominent reddish brown (5YR 4/4) masses of iron; common fine and medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 4 percent rock fragments; slightly effervescent; slightly alkaline; clear smooth boundary.
Cg—57 to 80 inches; light grayish brown (2.5Y 6/2) loam; massive; friable; few fine prominent light gray (10YR 7/2) masses of calcium carbonate; few fine prominent yellowish red (5YR 4/6) masses of iron; many medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 4 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to carbonates: 20 to 48 inches

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

Bg or Bw horizon:
Hue—10YR or 2.5Y
Value—3 or 4 in the upper part; 4 or 5 in the lower part
Chroma—2 to 4
Texture—loam or clay loam
Reaction—moderately acid to neutral in the upper part; slightly acid to slightly alkaline in the lower part

Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam, clay loam, or sandy loam
Reaction—slightly alkaline or moderately alkaline

Okoboji Series

Typical Pedon

Okoboji silty clay loam, depressional, 0 to 1 percent slopes, in a cultivated field in an upland depression; Webster County, Iowa; 220 feet east and 1,310 feet south of the northwest corner of sec. 26, T. 88 N., R. 29 W.; USGS Fort Dodge South, Iowa, topographic quadrangle; lat. 42 degrees 24 minutes 33 seconds N. and long. 94 degrees 12 minutes 10 seconds W., NAD 83:

Ap—0 to 6 inches; black (N 2/) silty clay loam, black (10YR 2/1) dry; weak fine granular and very fine subangular blocky structure; friable; slightly alkaline; abrupt smooth boundary.

A1—6 to 16 inches; black (N 2/) silty clay loam, black (10YR 2/1) dry; weak fine granular and very fine subangular blocky structure; friable; slightly alkaline; gradual smooth boundary.

A2—16 to 26 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular and very fine subangular blocky structure; friable; few very fine prominent olive (5Y 4/3) redoximorphic concentrations; slightly alkaline; gradual smooth boundary.

A3—26 to 32 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; firm; very few fine prominent olive (5Y 4/3) redoximorphic concentrations; few medium prominent olive gray (5Y 5/2) redoximorphic depletions; slightly alkaline; gradual smooth boundary.

Bg1—32 to 36 inches; very dark gray (N 3/) silty clay loam; weak very fine prismatic structure parting to weak very fine subangular blocky; firm; few fine prominent black (10YR 2/1) iron-manganese concretions; common fine distinct olive gray (5Y 5/2) redoximorphic depletions; slightly alkaline; clear smooth boundary.

Bg2—36 to 48 inches; dark gray (5Y 4/1) and olive gray (5Y 5/2) silty clay loam; weak fine prismatic structure parting to weak very fine subangular blocky; firm; common medium prominent black (10YR 2/1) iron-manganese concretions; few dark krotovinas; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bg3—48 to 56 inches; dark gray (5Y 4/1) and olive gray (5Y 5/2) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine prominent black (10YR 2/1) iron-manganese concretions; few dark krotovinas; common coarse prominent olive brown (2.5Y 4/4) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.

BCg—56 to 70 inches; dark gray (5Y 4/1) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine prominent black (10YR 2/1) iron-manganese concretions; few medium prominent olive brown (2.5Y 4/4) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg—70 to 80 inches; olive gray (5Y 5/2) silt loam; massive; friable; few fine and medium prominent black (10YR 2/1) iron-manganese concretions; thin strata of loam and sandy loam at 75 inches; many medium distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 60 inches
Depth to carbonates: 20 to 60 inches

Ap or A horizon:
Hue—10YR to 5Y or N
Value—2
Chroma—0 or 1

Texture—silty clay loam, mucky silty clay loam, silt loam, or mucky silt loam
Reaction—slightly acid to slightly alkaline

Bg horizon:
Hue—2.5Y, 5Y, or N
Value—3 to 6
Chroma—0 to 2
Texture—silty clay loam or silty clay
Reaction—neutral or slightly alkaline

BCg horizon:
Hue—2.5Y, 5Y, or N
Value—4 to 6
Chroma—0 to 2
Texture—silty clay loam
Reaction—slightly alkaline or moderately alkaline

Cg horizon:
Hue—2.5Y, 5Y, or N
Value—4 to 6
Chroma—0 to 2
Texture—silty clay loam, silt loam, or stratified silt loam, very fine sandy loam, or clay loam; loam, clay loam, or sandy loam below a depth of 60 inches in some pedons
Reaction—slightly alkaline or moderately alkaline

Omsrud Series

Typical Pedon

Omsrud loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field on a side slope; Webster County, Iowa; 2,480 feet north and 600 feet east of the southwest corner of sec. 17, T. 88 N., R. 27 W.; USGS Evanston, Iowa, topographic quadrangle; lat. 42 degrees 26 minutes 02 seconds N. and long. 94 degrees 01 minute 40 seconds W., NAD 83:

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

Bw1—7 to 13 inches; brown (10YR 4/3) loam; moderate fine and medium subangular blocky structure; friable; common very fine and fine roots; common distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; slightly acid; clear smooth boundary.

Bw2—13 to 19 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few very fine and fine roots; few fine distinct dark yellowish brown (10YR 4/6) iron concretions; neutral; abrupt wavy boundary.

Bk—19 to 44 inches; yellowish brown (10YR 5/4) loam; weak medium and coarse subangular blocky structure; friable; common medium prominent white (10YR 8/1) calcium carbonate masses and threads; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; few fine prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 5 percent rock fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—44 to 70 inches; yellowish brown (10YR 5/4) loam; massive; friable; few fine prominent white (10YR 8/1) calcium carbonate masses; common medium distinct strong brown (7.5YR 5/6) redoximorphic concentrations; few medium and coarse

distinct gray (10YR 5/1) redoximorphic depletions; about 5 percent rock fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—70 to 80 inches; yellowish brown (10YR 5/3) loam; massive; friable; few fine prominent white (10YR 8/1) calcium carbonate masses; many medium and coarse prominent strong brown (7.5YR 5/6) redoximorphic concentrations; common medium and coarse distinct gray (10YR 5/1) redoximorphic depletions; about 5 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 18 to 50 inches

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

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

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam, sandy loam, or clay loam
Reaction—slightly alkaline or moderately alkaline

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam, sandy loam, or clay loam
Reaction—slightly alkaline or moderately alkaline

Taxadjunct features: The Omsrud soils in map units 835D2 and 835E2 do not have a mollic epipedon. These soils are classified as fine-loamy, mixed, superactive, mesic Typic Eutrudepts.

Ridgeport Series

Typical Pedon

Ridgeport sandy loam, 0 to 2 percent slopes, in a cultivated field; Humboldt County, Iowa; 100 feet west and 600 feet south of the northeast corner of sec. 31, T. 91 N., R. 28 W.; USGS Humboldt, Iowa, topographic quadrangle; lat. 42 degrees 11 minutes 18 seconds N. and long. 94 degrees 16 minutes 59 seconds W., NAD 83:

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium granular structure; very friable; common fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.

A—8 to 15 inches; very dark brown (10YR 2/2) sandy loam, very dark brown (10YR 2/2) dry; weak fine and medium granular structure; very friable; common fine roots; about 3 percent gravel; neutral; clear smooth boundary.
BA—15 to 19 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine subangular blocky structure parting to weak fine granular; very friable; common fine roots; few faint dark brown (10YR 3/3) organic coatings on faces of peds; about 5 percent gravel; neutral; gradual smooth boundary.
Bw1—19 to 25 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; very friable; common fine roots; about 5 percent gravel; neutral; gradual smooth boundary.
Bw2—25 to 36 inches; brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; common fine roots; about 7 percent gravel; neutral; gradual smooth boundary.
2BC—36 to 46 inches; brown (7.5YR 4/4) and strong brown (7.5YR 4/6) loamy sand; weak fine and medium subangular blocky structure; very friable; about 10 percent gravel; neutral; abrupt smooth boundary.
2C1—46 to 58 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 20 to 25 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.
2C2—58 to 80 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 20 to 25 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to carbonates: 24 to 50 inches
Depth to contrasting material: 24 to 40 inches

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

BA horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—2 to 4
Texture—sandy loam
Reaction—neutral or slightly acid

Bw horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 or 4
Texture—sandy loam
Reaction—neutral to moderately acid

2BC horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—4 to 6
Texture—loamy sand
Reaction—neutral or slightly alkaline

2C horizon:
Hue—7.5YR or 10YR
Value—4 or 5

Chroma—3 to 6
Texture—sand, gravelly sand, or gravelly loamy sand
Reaction—slightly alkaline or moderately alkaline

Ridgeton Series

Typical Pedon

Ridgeton loam, 9 to 14 percent slopes, on a footslope in a bluegrass field; Webster County, Iowa; 1,740 feet north and 1,415 feet west of the southeast corner of sec. 25, T. 90 N., R. 29 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 34 minutes 40 seconds N. and long. 94 degrees 12 minutes 48 seconds W., NAD 83:

A1—0 to 11 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; friable; common very fine and fine roots; slightly acid; gradual smooth boundary.

A2—11 to 26 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; slightly acid; gradual smooth boundary.

A3—26 to 35 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure; friable; few very fine roots; neutral; gradual smooth boundary.

AB—35 to 45 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; friable; very few very fine roots; neutral; clear smooth boundary.

Bw1—45 to 51 inches; dark brown (10YR 3/3) loam; moderate fine and medium angular blocky and subangular blocky structure; friable; common fine very dark grayish brown (10YR 3/2) organic stains on faces of peds; neutral; abrupt wavy boundary.

Bw2—51 to 60 inches; olive brown (2.5Y 4/4) loam; weak coarse prismatic structure parting to weak fine subangular blocky; friable; few medium and coarse faint dark yellowish brown (10YR 3/4) and few fine prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 3 percent rock fragments; neutral; abrupt wavy boundary.

C—60 to 80 inches; light yellowish brown (2.5Y 6/3) loam; massive; friable; few black (10YR 2/1) iron-manganese concretions; few fine and medium prominent white (10YR 8/1) and very pale brown (10YR 8/2) calcium carbonate concretions and threads; common medium and coarse prominent strong brown (7.5YR 5/6) and common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 60 inches
Depth to carbonates: 40 inches or more

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

AB horizon:
Hue—10YR
Value—2 or 3
Chroma—2 or 3
Texture—loam or clay loam
Reaction—slightly acid or neutral

Bw horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—3 or 4
Texture—loam or clay loam
Reaction—slightly acid or neutral

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam, clay loam, or sandy loam
Reaction—slightly alkaline or moderately alkaline

Rockton Series

Typical Pedon

Rockton loam, 2 to 5 percent slopes, in a cultivated field on a stream terrace; Webster County, Iowa; 1,050 feet east and 2,150 feet north of the southwest corner of sec. 6, T. 90 N., R. 28 W.; USGS Humboldt, Iowa, topographic quadrangle; lat. 42 degrees 38 minutes 10 seconds N. and long. 94 degrees 12 minutes 13 seconds W., NAD 83:

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine and fine roots; slightly acid; abrupt smooth boundary.
A1—10 to 15 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine and fine roots; moderately acid; gradual smooth boundary.
A2—15 to 23 inches; very dark grayish brown (10YR 3/2) loam; weak fine subangular blocky structure; friable; common faint very dark gray (10YR 3/1) organic stains on faces of peds; few very fine roots; about 1 percent rock fragments; slightly acid; clear smooth boundary.
Bt—23 to 34 inches; brown (10YR 4/3) loam; weak fine and medium subangular blocky structure; friable; few distinct very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) clay films on faces of peds; few coarse prominent yellowish red (5YR 5/8) iron concentrations; about 2 percent rock fragments; slightly acid; abrupt wavy boundary.
R—34 inches; pale yellow (2.5Y 7/4), fractured limestone bedrock.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to bedrock: 20 to 40 inches

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

Chroma—1 or 2
Texture—loam
Reaction—moderately acid or slightly acid

Bt horizon:
Hue—10YR in the upper part; 10YR, 7.5YR, or 5YR in the lower part
Value—4 or 5
Chroma—3 or 4
Texture—loam, sandy clay loam, or clay loam
Reaction—moderately acid or slightly acid

Rolfe Series

Typical Pedon

Rolfe silty clay loam, depressional, 0 to 1 percent slopes, in an upland depression in a cultivated field; Webster County, Iowa; 1,720 feet west and 300 feet north of the southeast corner of sec. 19, T. 87 N., R. 27 W.; USGS Lehigh, Iowa, topographic quadrangle; lat. 42 degrees 19 minutes 33 seconds N. and long. 94 degrees 02 minutes 08 seconds W., NAD 83:

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

E—10 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium platy structure parting to weak very fine subangular blocky; friable; few fine roots; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; slightly acid; abrupt wavy boundary.

Btg1—17 to 30 inches; very dark gray (2.5Y 3/1) silty clay; strong medium angular blocky structure; very firm; very few fine roots; many distinct dark gray (2.5Y 4/1) clay coatings on faces of peds; slightly acid; gradual smooth boundary.

Btg2—30 to 38 inches; olive gray (5Y 5/2) silty clay; strong medium angular blocky structure; very firm; few distinct very dark gray (2.5Y 3/1) clay coatings on faces of peds; common very fine distinct light yellowish brown (2.5Y 6/4) redoximorphic concentrations; neutral; clear smooth boundary.

2Btg3—38 to 45 inches; olive gray (5Y 5/2) clay loam; moderate medium angular and subangular blocky structure; firm; few distinct very dark gray (2.5Y 3/1) clay coatings on faces of peds; common medium distinct light yellowish brown (2.5Y 6/4) redoximorphic concentrations; about 1 percent rock fragments; neutral; abrupt wavy boundary.

2Btg4—45 to 58 inches; olive gray (5Y 5/2) clay loam; moderate medium angular and subangular blocky structure; friable; common distinct very dark gray (2.5Y 3/1) clay coatings on faces of peds; few fine prominent white (10YR 8/1) masses of calcium carbonate; common fine prominent light brown (7.5YR 6/4) iron concentrations increasing with depth; neutral; abrupt wavy boundary.

2BCg—58 to 67 inches; olive gray (5Y 5/2) clay loam; moderate medium angular and subangular blocky structure; friable; very few fine and medium prominent white (10YR 8/1) masses of calcium carbonate; common fine and medium prominent strong brown (7.5Y 5/8) iron concentrations; about 3 percent rock fragments; slightly effervescent; slightly alkaline; abrupt wavy boundary.

2Cg—67 to 80 inches; light olive brown (2.5Y 5/3) clay loam; massive; friable; many medium prominent strong brown (7.5YR 5/8) iron concentrations; common medium prominent reddish brown (5YR 4/4) and yellowish red (5YR 4/6) iron stains; about 3 percent rock fragments; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to carbonates: 42 to 80 inches
Depth to glacial till: 24 to 60 inches

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

E horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—1 or 2
Texture—silt loam or loam
Reaction—strongly acid to slightly acid

Btg horizon:
Hue—2.5Y or 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silty clay or clay loam
Reaction—moderately acid to neutral

2Btg horizon:
Hue—5Y or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or loam
Reaction—slightly acid or neutral

2BCg or 2Cg horizon:
Hue—5Y or 2.5Y
Value—4 to 6
Chroma—1 to 3
Texture—clay loam or loam
Reaction—neutral or slightly alkaline in the 2BCg horizon; slightly alkaline or moderately alkaline in the 2Cg horizon

Romeo Series

Typical Pedon

Romeo silt loam, 0 to 2 percent slopes, in a pasture; Will County, Illinois; about 150 feet south and 1,280 feet east of the northwest corner of sec. 25, T. 37 N., R. 10 E.; USGS Romeoville, Illinois, topographic quadrangle; lat. 41 degrees 40 minutes 13 seconds N. and long. 88 degrees 02 minutes 27 seconds W., NAD 83:

A—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many very fine to coarse roots; 3 percent gravel; neutral; abrupt smooth boundary.
R—8 inches; unweathered limestone bedrock; strongly effervescent.

Range in Characteristics

Depth to bedrock: 2 to 10 inches

A or Ap horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—2 or 3
Chroma—1 or 2
Texture—loam, clay loam, silt loam, or silty clay loam
Reaction—slightly acid to moderately alkaline

Round Lake Series

Typical Pedon

Round Lake sandy loam, on a convex slope of 4 percent, in a cultivated field; Nobles County, Minnesota; 480 feet south and 1,500 feet east of the northwest corner of sec. 20, T. 104 N., R. 24 W.; USGS Wilmont, Minnesota, topographic quadrangle; lat. 43 degrees 48 minutes 13 seconds N. and long. 95 degrees 47 minutes 12 seconds W., NAD 83:

Ap—0 to 11 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; common very fine roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.

Bw1—11 to 14 inches; dark yellowish brown (10YR 3/4) sandy loam; moderate to weak fine subangular blocky structure; few dark brown (10YR 3/3) streaks on faces of peds; friable; clay bridging between sand grains; common very fine roots; about 4 percent gravel; slightly acid; gradual wavy boundary.

2Bw2—14 to 26 inches; dark brown (7.5YR 3/4) loamy coarse sand; weak medium subangular blocky structure parting to single grain; very friable; about 6 percent gravel; clay bridging between sand grains; neutral; gradual wavy boundary.

2Bk—26 to 35 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; common carbonate coatings on pebbles; few fine distinct yellowish brown (10YR 5/8) iron concentrations; about 17 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

2C—35 to 48 inches; yellowish brown (10YR 5/4) coarse sand; single grain; loose; few fine prominent strong brown (7.5YR 5/6) iron concentrations; about 12 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

3Cg—48 to 80 inches; grayish brown (2.5Y 5/2) silty clay loam with thin strata of silt; massive; moderately sticky; common medium prominent strong brown (7.5YR 5/6 and 4/6) iron concentrations; about 2 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 12 to 40 inches
Depth to glacial till: 40 to 60 inches

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

Bw horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, or loam
Reaction—moderately acid to neutral

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

2Bk horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—3 or 4
Texture—loamy coarse sand, coarse sand, sand, or loamy sand or the gravelly analogs of these textures
Reaction—slightly alkaline or moderately alkaline

2BC horizon (if it occurs):
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—3 or 4
Texture—loamy coarse sand, coarse sand, sand, or loamy sand or the gravelly analogs of these textures
Reaction—slightly acid to slightly alkaline

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 7
Chroma—3 to 6
Texture—coarse sand, sand, gravelly coarse sand, or gravelly sand
Reaction—slightly alkaline or moderately alkaline

3Cg or 3C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—silt loam, silty clay loam, loam, or clay loam
Reaction—slightly alkaline or moderately alkaline

Sattre Series

Typical Pedon

Sattre loam, in a nearly level area in a cultivated field on a stream terrace; Benton County, Iowa; about 550 feet east and 1,250 feet south of the center of sec. 2, T. 85 N., R. 10 W.; USGS Center Point NW, Iowa, topographic quadrangle; lat. 42 degrees 12 minutes 00 seconds N. and long. 91 degrees 58 minutes 32 seconds W., NAD 83:

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

E—8 to 13 inches; dark grayish brown (10YR 4/2) loam; common light brownish gray (10YR 6/2) (dry) sand and silt coatings on peds; weak medium platy structure; friable; slightly acid; clear wavy boundary.
BE—13 to 17 inches; brown (10YR 4/3) loam; dark brown (10YR 3/2) coatings on peds; moderate fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
Bt—17 to 32 inches; dark yellowish brown (10YR 4/4) loam; light brownish gray (10YR 6/2) (dry) sand and silt coatings on peds; moderate medium subangular blocky structure; friable; few roots; few fine and medium pores; few faint clay films on faces of a few peds; moderately acid; gradual smooth boundary.
BC—32 to 35 inches; brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; friable; few roots; few faint clay films on peds; moderately acid; clear smooth boundary.
2E—35 to 40 inches; yellowish brown (10YR 5/6) sand; single grain; loose; moderately acid; gradual smooth boundary.
3E and Bt—40 to 60 inches; brownish yellow (10YR 6/6) sand; single grain; loose; 1-inch-thick brown (7.5YR 5/4) lamellae at 45, 49, and 53 inches; about 10 percent gravel; moderately acid.

Range in Characteristics

Depth to sand and gravel: 30 to 40 inches
Depth to carbonates: More than 60 inches
Other features: In cultivated areas, the original E horizon is typically mixed with the Ap horizon.

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—loam or silt loam that has a high content of sand
Reaction—strongly acid to neutral

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

Bt horizon:
Hue—7.5YR or 10YR
Value—4
Chroma—3 or 4
Texture—loam, clay loam, or sandy clay loam
Reaction—strongly acid to neutral

2E horizon:
Hue—7.5YR or 10YR
Value—5 or 6
Chroma—4 to 6
Texture—medium and coarse sand that contains some gravel
Reaction—strongly acid to neutral

3E and Bt horizon:
Hue—7.5YR, 10YR, or 2.5Y

Value—5 or 6
Chroma—2 to 6
Texture—medium and coarse sand; lamellae of sandy loam are typical
Reaction—strongly acid to neutral

Shandep Series

Typical Pedon

Shandep loam, 0 to 1 percent slopes, in a pasture of native prairie grasses; Franklin County, Iowa; 1,675 feet south and 75 feet east of the northwest corner of sec. 36, T. 92 N., R. 19 W.; USGS Ackley NE, Iowa, topographic quadrangle; lat. 42 degrees 44 minutes 25 seconds N. and long. 93 degrees 02 minutes 42 seconds W., NAD 83:

A1—0 to 5 inches; black (N 2/) loam; moderate fine granular structure; friable; few pebbles; slightly acid; gradual smooth boundary.
A2—5 to 25 inches; black (N 2/) clay loam; moderate fine granular structure; friable; few pebbles; slightly acid; gradual smooth boundary.
A3—25 to 29 inches; black (5Y 2/1) and very dark gray (5Y 3/1) clay loam; weak medium granular structure; friable; few pebbles; slightly acid; clear wavy boundary.
Bg1—29 to 37 inches; dark gray (5Y 4/1) clay loam; weak fine and medium subangular blocky structure; friable; few pebbles; slightly acid; gradual wavy boundary.
Bg2—37 to 45 inches; gray (5Y 5/1) loam; weak fine and medium subangular blocky structure; friable; few pebbles; slightly acid; clear wavy boundary.
2Cg—45 to 60 inches; dark gray (5Y 4/1) loamy sand; single grain; loose; few pebbles; slightly acid.

Range in Characteristics

Thickness of the mollic epipedon: 26 to 36 inches
Depth to carbonates: More than 60 inches

A or Ap horizon:
Hue—5Y or N
Value—2 or 3
Chroma—0 or 1
Texture—clay loam, loam, or silty clay loam
Reaction—slightly acid to slightly alkaline

Bg horizon:
Hue—5Y or N
Value—4 or 5
Chroma—0 or 1
Texture—clay loam, loam, or silty clay loam
Reaction—slightly acid to slightly alkaline

2Cg horizon:
Hue—5Y
Value—4 or 5
Chroma—1
Texture—loamy sand, gravelly loamy sand, coarse sand, gravelly coarse sand, or gravelly loamy coarse sand
Reaction—slightly acid to moderately alkaline

Shorewood Series

Typical Pedon

Shorewood silty clay loam, 1 to 3 percent slopes, in a cultivated field on an upland flat; Webster County, Iowa; 1,100 feet east and 270 feet north of the southwest corner of sec. 26, T. 87 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 18 minutes 42 seconds N. and long. 93 degrees 57 minutes 59 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; friable; many very fine and fine roots; moderately acid; abrupt smooth boundary.

A—8 to 13 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; moderately acid; abrupt wavy boundary.

AB—13 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine angular blocky and subangular blocky structure; friable; common very fine roots; many distinct light gray (10YR 7/1) (dry) silt coatings on faces of peds; slightly acid; abrupt wavy boundary.

Btg1—17 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay; weak coarse prismatic structure parting to moderate fine and medium angular blocky and subangular blocky; firm; few very fine roots; common distinct very dark gray (10YR 3/1) clay films on faces of peds; about 1 percent rock fragments; slightly acid; gradual smooth boundary.

Btg2—26 to 34 inches; dark grayish brown (2.5Y 4/2) silty clay; weak coarse prismatic structure parting to moderate fine and medium angular blocky and subangular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds and on surfaces along root channels; many fine prominent yellowish brown (10YR 5/6) and common fine prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 1 percent rock fragments; neutral; gradual smooth boundary.

Btg3—34 to 43 inches; grayish brown (2.5Y 5/2) silty clay; weak coarse prismatic structure parting to weak fine and medium subangular blocky; friable; common distinct very dark gray (10YR 3/1) clay films on faces of peds and along surfaces of root channels; many fine prominent yellowish brown (10YR 5/6) and few fine prominent yellowish brown (10YR 5/8) redoximorphic concentrations; about 1 percent rock fragments; neutral; abrupt wavy boundary.

2BCg—43 to 49 inches; grayish brown (2.5Y 5/2) loam; weak coarse prismatic structure; friable; few distinct very dark gray (10YR 3/1) clay films on root channels; common prominent white (10YR 8/1) masses of calcium carbonate; few medium prominent yellowish red (5YR 5/6) iron concretions; many fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 4 percent rock fragments; slightly effervescent; slightly alkaline; gradual smooth boundary.

2Cg—49 to 67 inches; grayish brown (2.5Y 5/2) loam; massive; friable; few distinct very dark gray (10YR 3/1) clay films along surfaces of root channels in the upper part; common fine and medium black (10YR 2/1) iron-manganese concretions; few medium distinct light olive brown (2.5Y 5/4) and many fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 3 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

2C—67 to 80 inches; light olive brown (2.5Y 5/4) loam; massive; friable; common medium distinct black (10YR 2/1) iron-manganese concretions; very few fine prominent strong brown (7.5YR 5/8) and yellowish red (5YR 5/6) iron concretions; common fine and medium distinct grayish brown (2.5Y 5/2) redoximorphic

depletions; about 5 percent rock fragments (mostly shale); strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 22 inches
Depth to carbonates: 28 to 50 inches
Depth to glacial till: 30 inches or more

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

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

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

2BCg or 2C horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Spillville Series

Typical Pedon

Spillville loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; Webster County, Iowa; 620 feet north and 840 feet east of the southwest corner of sec. 36, T. 90 N., R. 30 W.; USGS Clare, Iowa, topographic quadrangle; lat. 42 degrees 33 minutes 36 seconds N. and long. 94 degrees 20 minutes 30 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; neutral; abrupt smooth boundary.
A1—8 to 34 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; gradual smooth boundary.
A2—34 to 47 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure; friable; common distinct black (10YR 2/1) organic stains on faces of peds; common distinct light gray (10YR 7/1) silt coatings on faces of peds; slightly acid; gradual smooth boundary.

A3—47 to 57 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; common distinct black (10YR 2/1) organic stains on faces of peds; common distinct light gray (10YR 7/1) silt coatings on faces of peds; neutral; gradual smooth boundary.
C1—57 to 75 inches; olive brown (2.5Y 4/3) loam; massive; friable; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual wavy boundary.
C2—75 to 80 inches; dark grayish brown (2.5Y 4/2) sandy loam; massive; friable; common fine faint grayish brown (2.5Y 5/2) redoximorphic depletions; about 1 percent gravel; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 40 to 60 inches
Depth to carbonates: More than 40 inches

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—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—slightly acid or neutral

Storden Series

Typical Pedon

Storden loam, in an area of Storden-Omsrud complex, 9 to 14 percent slopes, moderately eroded, in a cultivated field on an upland side slope; Webster County, Iowa; 2,100 feet west and 175 feet north of the southeast corner of sec. 26, T. 90 N., R. 29 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 34 minutes 24 seconds N. and long. 94 degrees 14 minutes 04 seconds W., NAD 83:

Ap—0 to 7 inches; mixed dark grayish brown (10YR 4/2) and brown (10YR 5/3) loam; moderate fine granular structure; friable; few very fine and fine roots; about 7 percent rock fragments; strongly effervescent; moderately alkaline; abrupt wavy boundary.
Bk1—7 to 29 inches; brown (10YR 5/3) loam; weak fine and medium subangular blocky structure; friable; few very fine and fine roots; common fine and medium prominent light gray (10YR 7/1) threads of calcium carbonate; few fine prominent strong brown (7.5YR 5/8) iron oxides; about 4 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bk2—29 to 47 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; friable; common fine and medium prominent light gray (10YR 7/1) threads of calcium carbonate; few very fine and fine prominent black (10YR 2/1) manganese concretions; about 4 percent rock fragments; strongly effervescent; moderately alkaline; clear smooth boundary.
C—47 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; few fine prominent light gray (10YR 7/2) masses of calcium carbonate; common very fine

and fine prominent black (10YR 2/1) manganese concretions; common fine and medium prominent strong brown (7.5YR 5/8) and few fine faint brown (7.5YR 4/4) redoximorphic concentrations; about 4 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

Ap or A horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 to 3
Texture—loam
Reaction—slightly alkaline or moderately alkaline

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—loam
Reaction—slightly alkaline or moderately alkaline

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

Sunburg Series

Typical Pedon

Sunburg loam, on a convex slope of 10 percent in a hay field; Kandiyohi County, Minnesota; 2,640 feet west and 140 feet north of the southeast corner of sec. 21, T. 120 N., R. 35 W.; USGS Solomon Lake, Minnesota, topographic quadrangle; lat. 45 degrees 10 minutes 56 seconds N. and long. 95 degrees 04 minutes 21 seconds W., NAD 83:

Apk—0 to 8 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; weak fine and medium subangular blocky structure; very friable; many fine roots; about 8 percent gravel; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bk—8 to 20 inches; brown (10YR 5/3) fine sandy loam; weak medium platy structure; very friable; common very fine roots; common threads and masses of calcium carbonate; about 10 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

C—20 to 80 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium platelike soil fragments; very friable; few threads and masses of calcium carbonate; common medium prominent strong brown (7.5YR 5/6) relict iron concentrations and light brownish gray (2.5Y 6/2) relict iron depletions; about 12 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Apk or A horizon:
Hue—10YR

Value—3 or 4
Chroma—1 to 3
Texture—loam, fine sandy loam, or sandy loam
Reaction—slightly alkaline or moderately alkaline

Bk and C horizons:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam, fine sandy loam, or sandy loam
Reaction—slightly alkaline or moderately alkaline

Talcot Series

Typical Pedon

Talcot clay loam, 0 to 2 percent slopes, in a cultivated field on an outwash plain; Webster County, Iowa; 1,660 feet west and 180 feet south of the northeast corner of sec. 4, T. 89 N., R. 29 W.; USGS Fort Dodge South, Iowa, topographic quadrangle; lat. 42 degrees 33 minutes 29 seconds N. and long. 94 degrees 16 minutes 20 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) clay loam, very dark gray (N 3/) dry; weak fine subangular blocky structure; friable; common fine and medium roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.
A1—7 to 14 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; friable; common fine and medium roots; strongly effervescent; slightly alkaline; clear smooth boundary.
A2—14 to 18 inches; very dark gray (5Y 3/1) clay loam, olive gray (5Y 5/2) dry; weak fine and medium subangular blocky structure; friable; common fine and medium roots; common distinct black (10YR 2/1) organic coatings on faces of peds; strongly effervescent; slightly alkaline; clear smooth boundary.
Bkg1—18 to 25 inches; dark gray (5Y 4/1) clay loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; few distinct very dark gray (5Y 3/1) organic coatings on faces of peds; few medium prominent light gray (10YR 7/2) masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bkg2—25 to 38 inches; olive gray (5Y 4/2) loam; weak medium subangular blocky structure; friable; few very fine and fine roots; few medium distinct light olive brown (2.5Y 5/4) iron concretions; few medium prominent light gray (10YR 7/2) masses of calcium carbonate; about 4 percent rock fragments; strongly effervescent; moderately alkaline; abrupt wavy boundary.
2Cg1—38 to 66 inches; olive gray (5Y 4/2) gravelly loamy sand; single grain; loose; few fine prominent light olive brown (2.5Y 5/6) iron concretions; about 20 percent rock fragments; strongly effervescent; slightly alkaline; gradual smooth boundary.
2Cg2—66 to 80 inches; light olive gray (5Y 6/2) gravelly sand; single grain; loose; common fine and medium prominent light olive brown (2.5Y 5/6) iron concretions; about 16 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 14 to 24 inches
Depth to contrasting material: 24 to 40 inches

Ap or A horizon:
Hue—10YR, 2.5Y, 5Y, or N

Value—2 or 3
Chroma—0 or 1
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

Bkg or Bg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam, silty clay loam, or loam
Reaction—slightly alkaline or moderately alkaline

2Cg horizon:
Hue—2.5Y or 5Y
Value—2 to 6
Chroma—2 to 6
Texture—coarse sand, sand, or loamy sand or the gravelly analogs of these textures
Reaction—slightly alkaline or moderately alkaline

Terril Series

Typical Pedon

Terril loam, 2 to 5 percent slopes, on a footslope in a cultivated field; Webster County, Iowa; 1,040 feet west and 100 feet south of the northeast corner of sec. 11, T. 89 N., R. 29 W.; USGS Fort Dodge North, Iowa, topographic quadrangle; lat. 42 degrees 32 minutes 37 seconds N. and long. 95 degrees 13 minutes 51 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine and fine roots; slightly acid; 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 parting to weak fine granular; friable; few very fine and fine roots; slightly acid; gradual smooth boundary.

A2—18 to 36 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; friable; few very fine roots; few distinct black (10YR 2/1) organic stains on faces of peds; neutral; gradual smooth boundary.

Bw1—36 to 45 inches; brown (10YR 4/3) loam; moderate fine and medium subangular blocky structure; friable; few distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; neutral; clear smooth boundary.

Bw2—45 to 53 inches; brown (10YR 4/3) loam; moderate fine and medium subangular blocky structure; friable; few fine and medium faint grayish brown (2.5Y 5/2) redoximorphic depletions; neutral; clear smooth boundary.

BC—53 to 63 inches; light olive brown (2.5Y 4/3) loam; weak fine and medium subangular blocky structure; friable; few fine prominent black (10YR 2/1) manganese concretions; common fine prominent strong brown (7.5YR 4/6) and common fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; abrupt wavy boundary.

C1—63 to 71 inches; light olive brown (2.5Y 5/3) loam; massive; friable; common fine prominent white (10YR 8/1) calcium carbonate masses; few fine prominent strong brown (7.5YR 4/6) and few fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; few fine shale fragments; strongly effervescent; slightly alkaline; abrupt wavy boundary.

C2—71 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; few medium and coarse prominent black (10YR 2/1) iron and manganese concretions; common fine and medium faint light olive brown (2.5Y 5/3) redoximorphic depletions; about 2 percent rock fragments; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 60 inches
Depth to carbonates: More than 40 inches

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—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, sandy loam, or clay loam
Reaction—slightly acid or neutral

C horizon:
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, 1 to 4 percent slopes, in a grass field on an alluvial fan; Webster County, Iowa; 1,500 feet west and 2,580 feet south of the northeast corner of sec. 10, T. 87 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 21 minutes 41 seconds N. and long. 93 degrees 58 minutes 35 seconds W., NAD 83:

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; common very fine and fine and few medium roots; slightly acid; abrupt smooth boundary.
A—9 to 20 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common very fine and fine and few medium roots; common distinct black (10YR 2/1) organic stains on faces of peds; slightly acid; gradual smooth boundary.
AB—20 to 30 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; friable; very few very fine roots; common distinct black (10YR 2/1) organic stains on faces of peds; slightly acid; clear smooth boundary.
Bg1—30 to 39 inches; dark grayish brown (2.5Y 4/2) loam; weak fine and medium subangular blocky structure; friable; common distinct very dark grayish brown

(10YR 3/2) organic stains on faces of peds; slightly acid; gradual smooth boundary.
Bg2—39 to 51 inches; dark grayish brown (2.5Y 4/2) loam; weak fine and medium subangular blocky structure; friable; few distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; slightly acid; gradual smooth boundary.
Bg3—51 to 61 inches; dark grayish brown (2.5Y 4/2) loam; weak fine and medium subangular blocky structure; friable; few distinct very dark gray (2.5Y 3/1) organic stains on faces of peds; slightly acid; clear smooth boundary.
BCg—61 to 74 inches; dark grayish brown (2.5Y 4/2) loam; very weak medium subangular blocky structure; friable; many distinct very dark gray (2.5Y 3/1) organic stains on faces of peds; many very fine and fine prominent black (10YR 2/1) manganese concretions; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid; abrupt wavy boundary.
Cg—74 to 80 inches; dark grayish brown (2.5Y 4/2) loam; massive; friable; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 36 inches
Depth to carbonates: More than 60 inches

Ap and A horizons:
Hue—10YR or N
Value—2
Chroma—0 to 2
Texture—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 or 3
Texture—loam or silt loam
Reaction—moderately acid to neutral

BCg and Cg horizons:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2
Texture—loam or silt loam
Reaction—moderately acid to neutral

2Cg horizon (if it occurs):
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

Wacousta Series

Typical Pedon

Wacousta silty clay loam, depressional, 0 to 1 percent slopes, in an upland depression in a cultivated field; Webster County, Iowa; 150 feet south and 1,745 feet east of the northwest corner of sec. 30, T. 86 N., R. 30 W.; USGS Churdan NE, Iowa, topographic quadrangle; lat. 42 degrees 14 minutes 14 seconds N. and long. 94 degrees 23 minutes 31 seconds W., NAD 83:

Ap—0 to 9 inches; black (N 2/) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

Bg—9 to 16 inches; gray (5Y 5/1) silty clay loam; weak fine and medium subangular blocky structure; friable; common fine and medium prominent yellowish brown (10YR 5/6 and 5/4) redoximorphic concentrations; neutral; abrupt wavy boundary.

Cg1—16 to 23 inches; olive gray (5Y 5/2) silt loam; massive; friable; few medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg2—23 to 41 inches; olive gray (5Y 5/2) silt loam; massive; friable; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg3—41 to 59 inches; olive gray (5Y 5/2) silt loam; massive; friable; few fine and medium prominent light gray (10YR 7/1) masses of calcium carbonate; few fine prominent strong brown (10YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg4—59 to 80 inches; gray (5Y 5/1) silt loam; massive; friable; few medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 18 inches
Depth to carbonates: 12 to 20 inches

Ap or A horizon:
- Hue—10YR or N
- Value—2
- Chroma—0 or 1
- Texture—silty clay loam, silt loam, or mucky silt loam
- Reaction—slightly acid to slightly alkaline

Bg horizon:
- Hue—2.5Y or 5Y
- Value—4 to 6
- Chroma—1 or 2
- Texture—silty clay loam or silt loam
- Reaction—neutral or slightly alkaline

Cg horizon:
- Hue—5Y
- Value—5 or 6
- Chroma—1 or 2
- Texture—silt loam or silty clay loam
- Reaction—slightly alkaline or moderately alkaline

Wadena Series

Typical Pedon

Wadena loam, 0 to 2 percent slopes, in a cultivated field on a stream terrace; Webster County, Iowa; 2,240 feet east and 1,140 feet south of the northwest corner of sec. 10, T. 89 N., R. 29 W.; USGS Clare, Iowa, topographic quadrangle; lat. 42 degrees 32 minutes 29 seconds N. and long. 94 degrees 15 minutes 29 seconds W., NAD 83:

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

A1—7 to 13 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; slightly acid; clear smooth boundary.

A2—13 to 17 inches; very dark grayish brown (10YR 3/2) loam; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; common distinct black (10YR 2/1) organic stains on faces of peds; slightly acid; clear smooth boundary.

Bw—17 to 30 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; common very fine roots; slightly acid; abrupt wavy boundary.

2C1—30 to 51 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; few very fine roots; about 25 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

2C2—51 to 80 inches; pale brown (10YR 6/3) coarse sand; single grain; loose; about 10 percent gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Depth to carbonates: 30 to 60 inches
Depth to contrasting material: 24 to 40 inches

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

Bw horizon:
- Hue—7.5YR or 10YR
- Value—3 to 6
- Chroma—3 or 4
- Texture—loam or clay loam
- Reaction—slightly acid or neutral

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

Wapsie Series

Typical Pedon

Wapsie loam, 2 to 5 percent slopes, in a cultivated field on a stream terrace; Webster County, Iowa; 1,300 feet west and 2,200 feet south of the northeast corner of sec. 22, T. 87 N., R. 27 W.; USGS Stratford, Iowa, topographic quadrangle; lat. 42 degrees 20 minutes 01 second N. and long. 93 degrees 58 minutes 33 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; about 1 percent rock fragments; friable; moderately acid; abrupt smooth boundary.

E—8 to 14 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; moderately acid; abrupt smooth boundary.

Bt1—14 to 21 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; few light gray (10YR 7/1) silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt2—21 to 31 inches; brown (7.5YR 4/4) sandy clay loam; weak medium subangular blocky structure; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; friable; strongly acid; clear smooth boundary.

Bt3—31 to 35 inches; brown (7.5YR 4/4) sandy clay loam; weak medium subangular blocky structure; friable; few dark brown (7.5YR 3/4) clay bridges between sand grains; about 5 percent rock fragments; moderately acid; abrupt wavy boundary.

2C1—35 to 40 inches; brown (7.5YR 5/4) gravelly sand; single grain; loose; about 15 percent rock fragments; moderately acid; clear smooth boundary.

2C2—40 to 60 inches; strong brown (7.5YR 5/6) gravelly sand; single grain; loose; thin strata of sandy clay loam at 48 to 49 inches; about 20 percent rock fragments; moderately acid; clear smooth boundary.

2C3—60 to 80 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 30 percent rock fragments; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: More than 60 inches
Depth to contrasting material: 20 to 36 inches

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

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

Bt horizon:
- Hue—7.5YR or 10YR
- Value—4 or 5
- Chroma—3 to 8

Texture—loam or sandy clay loam
Reaction—strongly acid or moderately acid

2C horizon:
Hue—7.5YR or 10YR
Value—5
Chroma—4 to 6
Texture—gravelly sand, gravelly loamy sand, or sand with some gravel
Reaction—moderately acid to slightly alkaline

Webster Series

Typical Pedon

Webster silty clay loam, 0 to 2 percent slopes, in a cultivated field on an upland flat; Webster County, Iowa; 160 feet south and 500 feet west of the northeast corner of sec. 4, T. 87 N., R. 28 W.; USGS Evanston, Iowa, topographic quadrangle; lat. 42 degrees 22 minutes 59 seconds N. and long. 94 degrees 06 minutes 29 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; about 2 percent rock fragments; neutral; abrupt smooth boundary.

A—7 to 13 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; about 2 percent rock fragments; neutral; gradual smooth boundary.

AB—13 to 24 inches; very dark gray (N 3/) silty clay loam, dark gray (5Y 4/1) dry; weak medium prismatic structure parting to moderate fine subangular blocky; friable; common fine prominent olive (5Y 4/3) redoximorphic depletions; about 2 percent rock fragments; neutral; gradual smooth boundary.

Bg1—24 to 30 inches; olive gray (5Y 4/2) clay loam; weak medium prismatic structure parting to weak fine subangular blocky; friable; common very dark gray (5Y 3/1) organic coatings on faces of peds; few fine prominent black (10YR 2/1) iron-manganese concretions; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; about 3 percent rock fragments; neutral; gradual smooth boundary.

Bg2—30 to 36 inches; olive gray (5Y 4/2) clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; many medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 3 percent rock fragments; neutral; abrupt wavy boundary.

BCg—36 to 50 inches; olive gray (5Y 5/2) loam; weak medium prismatic structure; friable; many fine and medium prominent light gray (10YR 7/1) masses of calcium carbonate; common fine and medium prominent olive brown (10YR 5/6) redoximorphic concentrations; about 3 percent rock fragments; slightly effervescent; moderately alkaline; gradual smooth boundary.

Cg1—50 to 67 inches; light olive gray (5Y 6/2) loam; massive; friable; few fine prominent black (10YR 2/1) iron-manganese concretions; few fine prominent light gray (10YR 7/1) masses of calcium carbonate; many fine and medium prominent light yellowish brown (10YR 5/6) redoximorphic concentrations; about 5 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg2—67 to 80 inches; light olive gray (5Y 6/2) loam; massive; friable; few fine black (10YR 2/1) iron-manganese concretions; few fine prominent light gray (10YR 7/1) masses of calcium carbonate; few fine prominent reddish brown (5YR 5/6) iron masses; many medium prominent yellowish brown (10YR 5/6) redoximorphic

concentrations; about 5 percent rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 14 to 24 inches
Depth to carbonates: 24 to 50 inches

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

Bg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or silty clay loam
Reaction—neutral or slightly acid

BCg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam or sandy loam
Reaction—slightly alkaline or moderately alkaline

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by five major soil-forming factors: the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material (Jenny, 1941). Human activities also affect soil formation.

Climate and plant and animal life are the active factors of soil formation. They act on the parent material through the weathering of rock and slowly transform it into a natural body consisting of genetically related horizons. The effects of climate and plant and animal life are also conditioned by relief. The parent material has a strong influence on the kind of soil profile that will be formed and in extreme cases determines it almost entirely. Finally, time is needed for the transformation of parent material into soil. The length of time may be short or long, but some time is required for the differentiation of soil horizons. A long period of time is generally required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

Climate

The soils in Webster County formed under a variety of climatic conditions (Kemmis and others, 1981; Ruhe, 1956). In the post-Cary glaciation period, 13,800 to 10,500 years ago, the climate was cool and the vegetation was dominantly conifers. During the period beginning about 10,500 years ago and ending about 8,000 years ago, a warming trend changed the vegetation from conifers to mixed hardwoods. Beginning about 8,000 years ago, the climate became warmer and drier and herbaceous prairie vegetation was dominant. A change from a dry climate to a moister one began about 3,000 years ago (Walker, 1966b). The soils in the county formed under the influence of this subhumid, midcontinental climate.

A nearly uniform climate presently prevails throughout the survey area. The general climate has had an important overall influence on the characteristics of the soils but has not created major differences among them. The influence of the general climate of the region, however, is modified by local conditions. For example, soils on south-facing slopes formed under a microclimate that is warmer and less humid than the average climate in nearby areas. The climate under which poorly drained or very poorly drained soils in low areas, such as bottom lands or depressions, have been forming is typically wetter and colder than in most of the surrounding areas.

Climate indirectly affects soil formation through the effects of temperature and other climatic factors by influencing plant and animal life that live in or on the soil. Fluctuations in temperature can increase or decrease the weathering of parent materials by water and air. When these parent materials weather, complex physical and chemical actions take place. Rainfall has an overwhelming effect on the rate of leaching in the soil and on the kinds of plants that grow on the soil.

Living Organisms

All living organisms, including vegetation, animals, bacteria, and fungi, are important factors of soil formation, and plants are especially significant (McComb and Riecken, 1961). Native grasses typically have an abundance of above-ground growth in addition to a myriad of fibrous roots that penetrate the soil to an average depth of 10 to 20 inches. As these plants grow and, mainly, when they die, they add large amounts of nutrient-enriched organic material to the surface layer and subsoil. Trees absorb essential nutrients from deep within the subsoil and contribute very little organic material to the surface layer. Much of the organic material from dead trees actually remains on the soil surface in the form of fallen leaves, twigs, and branches.

Most of the soils in Webster County formed under prairie grasses or a mixture of prairie grasses and water-tolerant plants. Some soils formed strictly under vegetation consisting of water-tolerant plants. Clarion soils formed under prairie grasses. In areas that have not eroded, these soils typically have a dark surface layer that is 10 to 20 inches thick and have a content of organic matter of 3 to 5 percent. Webster soils formed under a mixture of prairie grasses and water-tolerant plants. Okoboji soils formed under water-tolerant plants. These soils typically have a black surface layer that is 20 to more than 30 inches thick and have a very high content of organic matter.

All living organisms, including vegetation, animals, bacteria, and fungi, affect soil formation. The vegetation dominantly determines the color of the surface layer, the content of organic matter, and the nutrients in the soil. Earthworms and other burrowing animals also assist in the development and maintenance of soil porosity. Bacteria and fungi decompose the vegetation and thereby release plant nutrients.

Topography

Relief indirectly influences soil formation through its effect on soil drainage, runoff, and erosion. In the steeper areas, more water runs off the surface and less infiltrates the soil. The higher runoff rate results in less leaching of carbonates and less movement of clay from the surface horizon into the subsoil. The susceptibility to erosion increases as the slope increases. Much of Webster County is nearly level to moderately sloping, but in small areas, particularly along the major rivers and streams, slopes can be steep or very steep.

The aspect of the slope also affects soil formation, especially in the steeper areas. For example, south-facing slopes generally are warmer and drier than north-facing slopes. As a result, they typically support different kinds of vegetation.

The moderately steep to very steep Lester soils, gently sloping to strongly sloping Clarion soils, and nearly level and very gently sloping Nicollet soils, all of which formed in the same kind of parent material and under similar vegetation, differ because of differences in topographic position. Slope has a significant effect on the development of the A horizon and the solum. For instance, the A horizon and the solum are generally thicker and darker in a soil in the less sloping areas than they are in a soil in the steeper areas.

The nearly level and depressional soils in Webster County commonly have a gray or mottled subsoil resulting from poor aeration and restricted internal drainage. Okoboji and Webster soils are examples. In the depressional Okoboji soils, water is periodically impounded on the surface, sometimes for weeks or longer. Rolfe soils are another example of depressional soils that impound water and are very poorly drained. As the Rolfe soils formed, the impounded water percolated through the surface layer, removing clay-sized particles and redepositing them in the subsoil. This movement of clay accelerated the formation of the Rolfe soils. These soils typically have a distinctly silty, light-colored subsurface layer and a gray, clayey subsoil.

The micro-relief of the nearly level Coland and Spillville soils on bottom land affects runoff, depth to the water table, and the rate at which new sediments are deposited. Coland soils are in low positions on the landscape, generally some distance from the main stream channel. They are poorly drained and impound water for short periods. Spillville soils are typically slightly higher on the landscape than the Coland soils, are generally closer to the stream channel, and are better drained.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. Most soils formed in material that was transported from the site of the parent material and redeposited at a new location through the action of glacial ice, water, wind, or gravity.

The most common kinds of parent material in Webster County are glacial drift, alluvium, lacustrine sediments, and organic material. A few soils formed in deposits of loamy sediments overlying limestone bedrock or shale.

Glacial drift is rock material transported and deposited by glacial ice, including the material sorted and unsorted by meltwater. It includes till, glacial sediments, and glacial outwash. Till consists of unsorted deposits in which particles range in size from boulders to clay. Glacial sediments are the loamy materials that have been sorted to some extent by water. The fact that these sediments are in potholes or in other low areas on the landscape indicates that some of the sorting and deposition occurred since the time of glaciation as well as during the ice age. Glacial outwash is the sandy and gravelly material sorted by glacial meltwater and deposited in valleys (generally on relatively flat outwash plains) or in other areas where water was concentrated.

The area that is now Webster County underwent at least three major episodes of glaciation. These include at least two early Pleistocene glacial stages (previously called the Nebraskan and Kansan but now referred to collectively as the Pre-Illinoian) and the younger Wisconsin glacial stage. The Pre-Illinoian till in Webster County is buried in all areas by drift of the Wisconsin glacial stage.

Most of the soils in Webster County formed in till of the Cary Substage of the Wisconsin glacial period (Ruhe, 1969). This area is often referred to as the Cary Lobe or Des Moines Lobe. Radiocarbon dating indicates that this drift was deposited about 12,500 to 14,000 years ago. Most of the soils of the Cary Substage occur on ground moraines and end moraines. Clarion, Nicollet, and Storden soils formed in till of the Cary Substage. Canisteo, Harps, and Webster soils are in the lower areas on the landscape and formed in loamy sediments and till (Walker, 1966a). Okoboji soils formed in sediments derived from till that in some places eroded from nearby slopes. Estherville and Hawick soils formed in glacial outwash.

Alluvium is sediment deposited by water along rivers and streams, in upland drainageways, in depressional areas, and on stream terraces. The texture of alluvium varies widely because of the differences in the material from which it was derived and the manner in which it was deposited. Coland and Spillville soils formed in alluvium on bottom land that was subject to flooding, typically within large watershed areas. Alluvium that has been transported only a short distance is referred to as local alluvium. Local alluvium retains many of the characteristics of the soils from which it was transported. Local alluvium transported and deposited by the forces of gravity, typically at the base or on footslopes of much steeper slopes, is often referred to as colluvium. Terril soils formed in local alluvium and/or colluvium, commonly downslope from soils that formed in till. Biscay, Cylinder, and Wadena soils formed in loamy alluvium underlain by sand and gravel on stream terraces. The material in which these latter soils formed was mainly deposited by the meltwater from the receding Cary glacial substage.

Lacustrine or glaciolacustrine sediment is typically fine textured, water-sorted material deposited by nearly still waters near the margin of the glacial ice rather than

by rapidly moving meltwater. Lacustrine sediments originated as deposits in depressions and troughs on the Cary ice sheet. When the glacial ice melted, the sediments remained in closed depressions surrounded by till, or they stood out in relief as ridges. Lacustrine sediments are typically silty clay loam or silty clay and commonly range from 3 to 5 feet in thickness. Marna and Guckeen soils are examples of soils that formed in this material. The most extensive area of lacustrine sediments in Webster County occupies the lower half of the county.

Many unique areas of organic material, called fens, are found throughout Webster County. These fens are the products of the seepage of ground water to the surface, typically on steep or very steep slopes. This seepage usually originates from water-saturated gravel that is underlain by an impermeable layer, such as a denser till. These areas typically have hydrophytic flora and fauna that cannot exist in any other environment. As a result, fens support many plant species considered endangered or threatened in Iowa. Most of the original organic soils in the county, including many of the fen areas, have been artificially drained.

Time

The passage of time enables relief, climate, and plant and animal life to bring about changes in the parent material. If these factors are active for long periods, very similar kinds of soil can form in different kinds of parent material. Soil formation, however, is generally interrupted by geologic events that expose new parent materials.

Geologically, the soils of Webster County are young. The radiocarbon technique for determining the age of carbonaceous material found in organic deposits and in till has made it possible to determine the approximate age of the soil materials in Iowa. The Cary Substage of the Late Wisconsin Glaciation has been determined to be about 13,000 years old. All of the soils that formed in Cary drift in Iowa are no more than 13,000 years old. In much of Iowa, including Webster County, geologic erosion has beveled and in places removed material from side slopes and deposited new sediments downslope (Walker, 1966b). Thus, the soils on these side slopes, such as Clarion and Lester soils, are less than 13,000 years old. Further dating and research indicate that these soils are less than 3,000 years old (Walker, 1966b). The sediments that were washed from the side slopes accumulated downslope. These sediments would have been deposited on the depressional soils, such as Okoboji and Wacousta soils. Some of the alluvium that was deposited at the base of steep side slopes and on bottom land along major rivers and streams is less than 3,000 years old. Terril soils on footslopes and Coland and Spillville soils on bottom land represent some of the younger soils in Webster County.

Human Activities

With the increase in land development, such as new construction of homes and commercial buildings, soils can be significantly altered. Some of these changes have little effect on the processes of soil formation but may have a more profound effect on soil properties.

Soil erosion, generally, is the most significant. Some of the cultivated or excavated soils in the county, particularly the steeper ones, have lost much of the original surface layer through sheet erosion. This loss of organic matter as well as the finer structure typical in the upper part of the soil profile can reduce the vegetative cover and increase the runoff rate. Fortunately, because the county is mostly composed of low-relief topography, many of the soils have not been significantly affected by accelerated erosion.

Furthermore, artificial drainage of the soils has improved conditions for cultivated crop growth but conversely has lowered the water table, increased soil temperature,

and changed the properties of these normally cooler, wetter soils. Such human activities as soil excavation, tree removal, and construction can also alter the natural soil formation processes through soil compaction and the subsequent decrease in percolation rates.

Sound management practices have increased the productivity of some soils, thereby reclaiming areas that were not suitable for crop production. For instance, in many areas where subsurface drainage has sufficiently lowered the water table, crops can now be grown. In addition, with the application of commercial fertilizers, soil productivity has increased. These fertilizers have helped to overcome plant nutrient deficiencies and increased the content of organic matter in the soils, particularly in moderately or severely eroded areas.

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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. 7). 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.

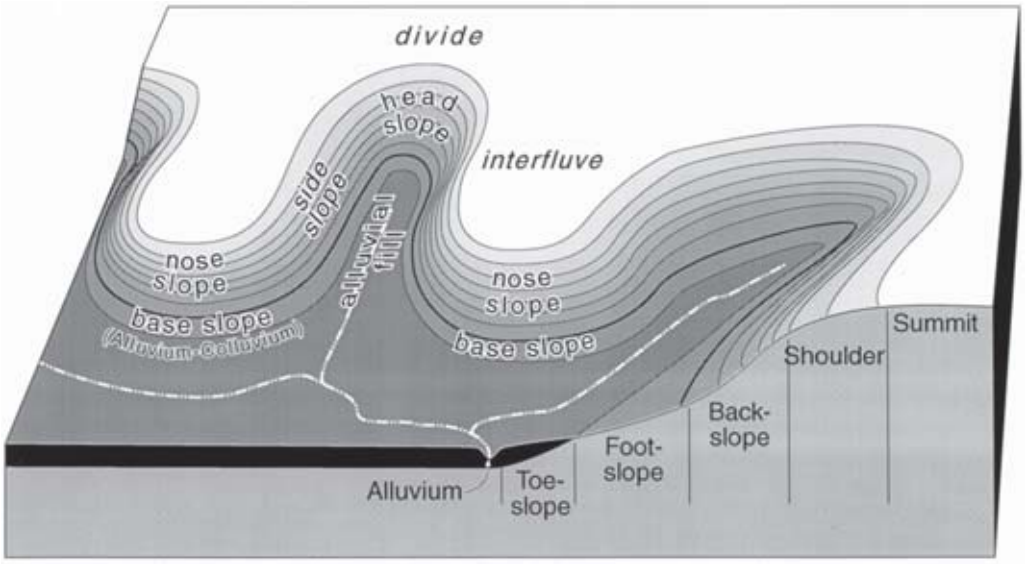

Figure 7.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

Base slope (geomorphology). A geomorphic component of hills (fig. 7) 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. 7); 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. 7). 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. 7). 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. 7).

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. 7); 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. 7). 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. 7). 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. 7). 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. 7). 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. 7). 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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