Soil Survey of Crawford County, Iowa

Part I

United States Department of Agriculture

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

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 (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 2002. Soil names and descriptions were approved in 2004. 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 Crawford County Soil and Water Conservation District.

Cover: Contour farming and terraces in an area of Marshall soils. Corn and soybeans are planted in this area in alternate seasons.

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

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Issued 2007

Foreword

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

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

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

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

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

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Soil Survey of
Crawford 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

CRAWFORD COUNTY is in west-central Iowa (fig. 1). It has an area of 457,200 acres, or about 713 square miles. It is bounded on the west by Monona County, on the east by Carroll County, on the north by Ida and Sac Counties, and on the south by Shelby County. Denison is the county seat.

This survey updates a previous survey of Crawford County published in 1973 (Kovar and others, 1973).

General Nature of the Survey Area

This section provides some general information about the survey area. It describes history; resources, transportation facilities, and recreation; cropland; physiography, relief, and drainage; and climate.

History

The survey area was at various times a part of the empires of three European powers: Spain, England, and France. These countries did little to govern this territory, which had been the tribal hunting grounds of several indigenous peoples, including the Sioux, Omaha, and Otoe tribes and occasionally the Potawatomi. Game was plentiful.

As a result of the Louisiana Purchase in 1803, the survey area became part of the United States.

Crawford County was established in 1851. It was named in honor of William Harris Crawford, a statesman from Georgia, who served as U.S. Senator, Secretary of War, Secretary of the Treasury, and Minister to France and was a presidential candidate in 1824.

The early settlers of Crawford County came from three sources: the natural migration from the east starting in 1849, the Mormon migration from the west in 1846, and the promotion of land on the frontier by the Providence Western Land Company of

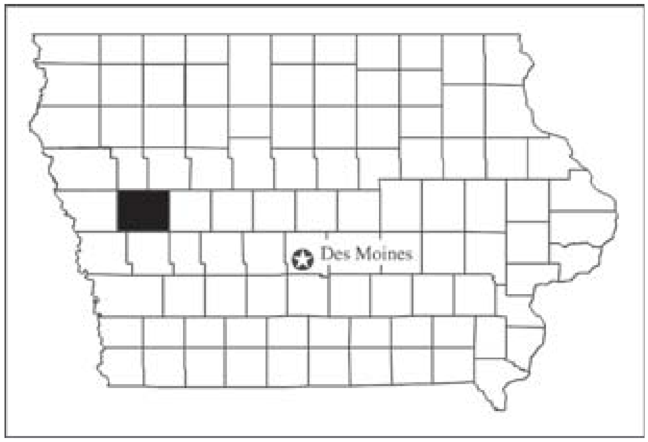

Figure 1.—Location of Crawford County in Iowa.

Providence, Rhode Island. The company had purchased 20,000 acres in the center of Crawford County. Jesse W. Denison was chosen by this company to carry on the work of beginning a settlement and encouraging settlers to buy the company's land. He arrived in Crawford County in 1856 to find about 235 settlers scattered throughout the county. Within 15 years the population of Denison was 800 and growing fast.

The first railway arrived in Crawford County in 1867. The railroad greatly improved transportation and access to markets and thus affected the settlement and development of the entire county.

Resources, Transportation Facilities, and Recreation

The most valuable natural resources in Crawford County are the soils on agricultural lands. Most of the acreage in the county is devoted to farmland. Farming is diversified and includes crop production and livestock. Areas in the uplands that are less sloping are well suited to row crops, forage, and pasture.

Sand and gravel are in many parts of the county. These resources typically occur in association with major streams and rivers.

Wildlife is plentiful in Crawford County. Deer, pheasant, turkey, quail, and small furbearers are common because of good habitat and an adequate food supply. Fish are common in the rivers, ditches, and impoundments in the county.

The county has a good farm-to-market road system. Federal, State, and county highways provide good access to all parts of the county. State Highway 30 runs east and west through Westside, Vail, Denison, Arion, and Dow City. State Highway 59 runs north and south through Schleswig and Denison. State Highway 39 runs north and south through Kiron, Deloit, and Denison. State Highway 141 runs east and west through Charter Oak, Denison, and Aspinwall. Paved county roads and gravel roads provide additional transportation routes.

Railroad freight service is available in Dow City, Arion, Denison, Deloit, Vail, Westside, Manilla, and Aspinwall. Truck service is available to all communities. Bus service is available in many parts of the county. Small aircraft are served at Denison. The closest commercial flights are in Sioux City and Omaha.

State and county parks provide facilities for camping, fishing, hunting, picnicking, hiking, and sightseeing (fig. 2). Many of the towns in the county have well furnished city parks.

Cropland

In 2002, according to the Iowa Agricultural Statistics Service, about 445,913 acres in Crawford County was used as farmland and the average farm size was 481 acres. About 394,932 acres was used for crops, and about 50,982 acres was used as pasture, was enrolled in a government set-aside program, or was used for other purposes. About 177,115 acres was used for corn for grain; 2,677 acres for corn for silage; 163,877 acres for soybeans; 1,105 acres for oats; and 17,036 acres for forage, grass silage, green chop, and other hay.

The soils in Crawford County have good potential for sustained, efficient crop production provided they are managed according to their properties and capabilities. The information in this soil survey can be used to apply the crop production technology necessary for sustained, efficient crop production.

Water erosion is the major management concern in areas used as cropland. It is a hazard where the slope is more than about 2 percent. It becomes progressively more severe with increasing slope. Sheet and rill erosion is the most common type of water erosion in the county, but gully erosion also occurs in some areas. Most gully erosion occurs in the more sloping areas of Monona, Ida, Marshall, and Exira soils. Accelerated runoff from the adjacent, less sloping cultivated soils on ridgetops increases the rate of gully erosion on the more sloping soils on side slopes in these areas.

Water erosion reduces the efficiency of crop production. Research indicates that yields are reduced by topsoil losses and that additional fertilizers can only partially compensate for lost topsoil. Fertilizers and other soil-applied chemicals are lost along with topsoil when soils erode.

The amount of soil loss is sometimes underestimated because tillage typically maintains the thickness of the surface layer by incorporating material from the

Figure 2.—Nelson Park Pond provides water for recreational activities and helps to control erosion in waterways downstream. The pond is in an area of Knox silt loam, 20 to 30 percent slopes.

subsurface layer or subsoil. When this material is incorporated into the surface layer, the content of organic matter and the level of fertility are reduced. The reduced content of organic matter in the surface layer increases the hazard of erosion. Research has shown that uneroded areas of Monona soils are much less erodible than soils that have similar textures but contain less organic matter (Meyer and Harmon, 1984).

Landscape position can also affect the erodibility of the soils (Johnson, 1988). For example, Monona soils on the upper side slopes and on some convex ridgetops are more susceptible to erosion than Monona soils that are on the lower side slopes.

Erosion can be controlled by cultural practices, erosion-control structures, or both. Cultural practices include farming on the contour and applying a system of conservation tillage that maintains a protective cover of residue on at least 30 percent of the surface. Erosion-control structures, such as terraces and sediment-control basins, can reduce the effective slope length.

Conservation tillage systems have both short-term and long-term benefits. Increasing the amount of crop residue on the soil surface reduces the runoff rate and the hazard of erosion in sloping areas. Most conservation tillage systems also require less total tillage than other systems. Over a long period, soils that have received less tillage have a higher content of organic matter and a higher level of nitrogen than other soils, even where there is no difference in degree of erosion (Lamb and others, 1985). Other changes in the physical and chemical properties of the soils are associated with conservation tillage. Most of these changes improve soil productivity or reduce production costs. In some soils under certain conditions, more soil nitrogen is lost through leaching and as gaseous nitrous oxide under a no-till system than under a conventional tillage system. In general, the most effective conservation tillage systems are those that leave the largest amount of crop residue on the soil surface.

Information about drainage and assistance in designing artificial drainage systems are available at the local office of the Natural Resources Conservation Service.

Physiography, Relief, and Drainage

The highest elevation in Crawford County is 1,560 feet. It is in the northeastern part of the county. The elevation changes in the county are relatively small.

Crawford County is part of a large upland plain that slopes generally to the southwest and drains into the Missouri River. The once relatively smooth plain has been incised by streams, and the topography ranges from nearly level to steep. Generally, the surface of the upland is characterized by rounded ridges and smooth slopes to the stream channels. Some areas are quite hilly and have steep slopes to the streams. The most hilly and sharply dissected areas are in the southwestern part of the county. The eastern part of the county has more uniform topography and is generally gently rolling. Stream channels are not so deeply incised, and erosion has not been as severe as in the rougher areas of the county.

In this region of western Iowa, the flat upland summits disappear almost entirely. The hills here appear as long, parallel crests of steep waves with broad troughs between them. The most extensive areas of level terrain occur along valley floors. The flood plains here and elsewhere across the state thus mark the lowest and youngest (Holocene) erosion surface cut into the landscape (Prior, 1991).

The county has a well developed natural drainage system, and streams and intermittent drainageways extend into all parts. Eventually, all of the drainage goes into the Missouri River. The Boyer River and its tributaries make up the primary drainage system that extends from the northeastern to the southwestern part of the county. Some of the larger tributaries of the Boyer River are Buffalo, Otter, Tucker, Trinkle, and Beaman Creeks. The Soldier, Middle Soldier, and East Soldier Rivers and Beaver Creek are the principal streams in the northwestern part of the county. Willow, Middle Willow, and South Willow Creek drain the southwestern part of the county and flow generally parallel to the Boyer River. The Nishnabotna River and its tributaries drain the southeastern part of the county. Straightening and enlarging of the channels of the Boyer, Soldier, and Nishnabotna Rivers have largely eliminated damage from floods. In some places artificial drainage channels have been constructed at the junction of the creeks with the major streams.

The soils on the uplands in the county are mainly well drained. Colo and Zook soils on bottom land are poorly drained. In places artificial drainage is needed to achieve the most intensive use of these soils.

Climate

Tables providing information on the climate of the survey area are at the end of this section. Table 1 gives data on temperature and precipitation for the survey area as recorded in the period 1971-2000 at Denison, Iowa. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 22.3 degrees F and the average daily minimum temperature is 13.6 degrees. The lowest temperature on record is -39 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 82.3 degrees. The highest temperature on record is 105 degrees.

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

The average annual total precipitation is 30.42 inches. Of this total, 18.8 inches, or about 62 percent, usually falls in May through September. The growing season for most crops falls within this period.

The average seasonal snowfall is 35.9 inches. On an average, 66 days per year have at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The sun shines 70 percent of the time possible in summer and around 55 percent in winter. The prevailing wind is from the northwest from November to April and from the south during the rest of the year. Average windspeed is highest, around 13 miles per hour, in April.

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 107. 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/NRCS, 2006). Crawford County is a subset of MLRA 107. Map unit design is based on documentation of the occurrence of soil components throughout the MLRA.

The information in Part I of this survey includes brief descriptions of the soils and miscellaneous areas and descriptions of taxonomic units. Part II provides information on soil properties and their subsequent effects on suitability, limitations, and management of the soils for specified uses. Part III includes the detailed soil maps for the survey area.

During the fieldwork for this survey, soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landscape or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

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

Soil scientists recorded the characteristics of the soil profiles that they observed. The maximum depth of observation was about 80 inches (6.7 feet). The 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 seasonal 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 understanding of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Table 1.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Denison, 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----	27.8	9.8	18.8	56	-19	0	0.80	0.23	1.41	2	7.8
February---	33.9	16.1	25.0	65	-17	0	.75	.31	1.07	2	6.6
March------	46.1	26.4	36.3	78	-3	21	2.16	.77	3.54	4	6.3
April------	59.9	37.9	48.9	88	16	111	3.03	1.51	4.26	6	2.3
May--------	71.3	49.8	60.6	89	31	338	4.14	2.54	5.50	7	.0
June-------	80.8	59.5	70.2	97	42	603	4.26	2.34	6.06	6	.0
July-------	84.2	64.0	74.1	98	50	748	3.87	1.51	6.02	6	.0
August-----	81.9	61.8	71.8	96	47	676	3.23	1.44	5.00	5	.0
September--	74.9	52.7	63.8	93	32	420	3.30	1.37	4.82	5	.0
October----	62.5	41.1	51.8	85	20	148	2.30	1.04	3.58	4	.7
November---	44.3	27.0	35.7	71	1	13	1.58	.60	2.48	3	4.1
December---	31.2	14.8	23.0	59	-15	0	1.00	.45	1.49	2	8.1
Yearly:											
Average---	58.2	38.4	48.3	---	---	---	---	---	---	---	---
Extreme---	105	-27	---	100	-22	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,079	30.42	23.96	36.71	52	35.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Denison, 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. 16	Apr. 28	May 9
2 years in 10 later than--	Apr. 12	Apr. 23	May 4
5 years in 10 later than--	Apr. 5	Apr. 14	Apr. 25
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 15	Oct. 2	Sept. 21
2 years in 10 earlier than--	Oct. 20	Oct. 8	Sept. 26
5 years in 10 earlier than--	Oct. 30	Oct. 19	Oct. 6

Table 3.--Growing Season

(Recorded in the period 1971-2000 at Denison, 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	191	168	142
8 years in 10	196	174	149
5 years in 10	207	186	162
2 years in 10	217	198	175
1 year in 10	222	205	182

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—Monona-Napier-Ida Association (fig. 3)

Extent of the association in the survey area: 19 percent

Component Description

Monona, moderately eroded, and similar soils
Extent: 40 to 70 percent of the association
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 2 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Napier and similar soils
Extent: 15 to 35 percent of the association
Geomorphic setting: Drainageways
Position on the landform: Footslopes, toeslopes
Slope range: 2 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

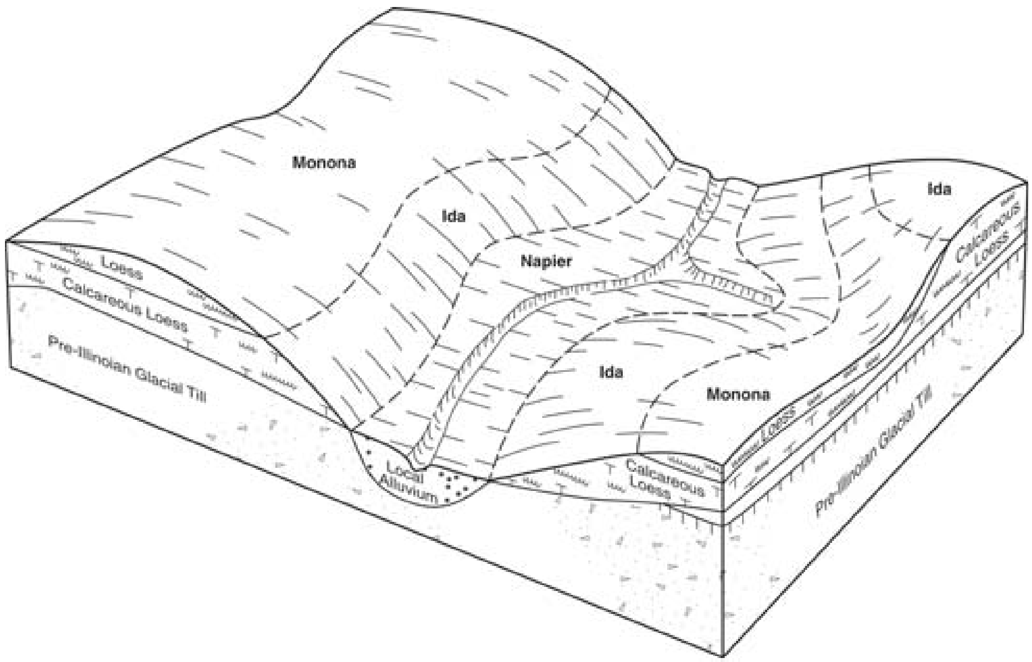

Figure 3.—Typical pattern of soils and parent material in the Monona-Napier-Ida association.

Parent material: Local alluvium
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Ida, severely eroded, and similar soils
Extent: 10 to 25 percent of the association
Geomorphic setting: Loess hills
Position on the landform: Summits, shoulders
Slope range: 5 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.7 percent

Minor Dissimilar Components

Kennebec
Extent: 0 to 10 percent of the association

Nodaway
Extent: 0 to 5 percent of the association

2—Monona Association (fig. 4)

Extent of the association in the survey area: 35 percent

Component Description

Monona, moderately eroded, and similar soils
Extent: 50 to 75 percent of the association
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 2 to 30 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Ida, severely eroded, and similar soils
Extent: 5 to 15 percent of the association

Judson and similar soils
Extent: 5 to 20 percent of the association

Ackmore and similar soils
Extent: 0 to 10 percent of the association

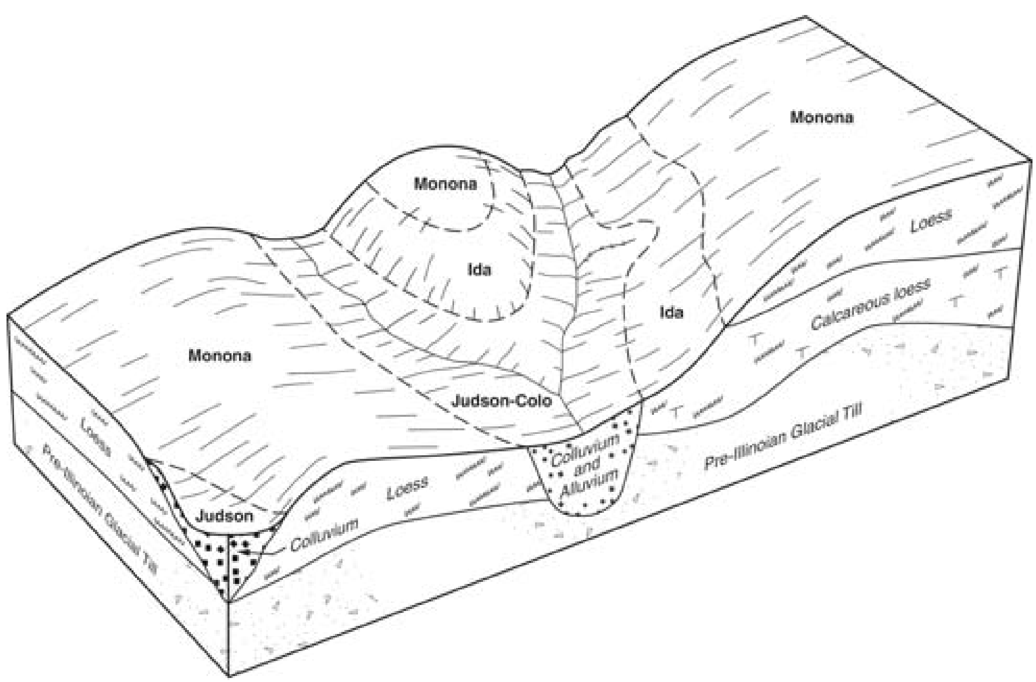

Figure 4.—Typical pattern of soils and parent material in the Monona association.

Colo, overwash, and similar soils
Extent: 0 to 10 percent of the association

3—Marshall-Judson Association (fig. 5)

Extent of the association in the survey area: 38 percent

Component Description

Marshall, moderately eroded, and similar soils
Extent: 60 to 80 percent of the association
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 0 to 18 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Judson and similar soils
Extent: 5 to 25 percent of the association
Geomorphic setting: Alluvial fans; drainageways
Position on the landform: Footslopes
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: Well drained
Parent material: Colluvium

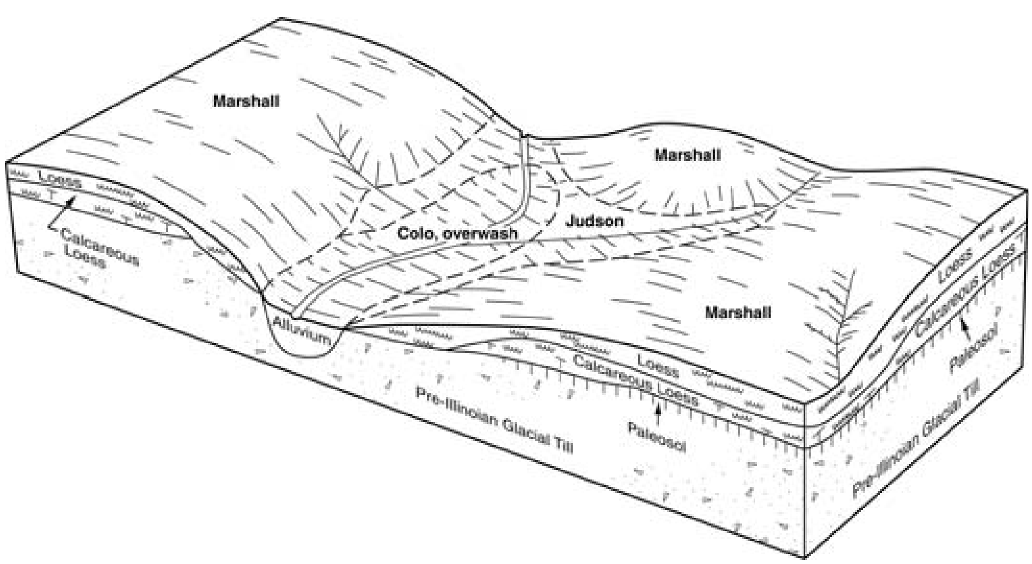

Figure 5.—Typical pattern of soils and parent material in the Marshall-Judson association.

Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Ackmore and similar soils
Extent: 0 to 15 percent of the association

Colo, overwash, and similar soils
Extent: 0 to 10 percent of the association

4—Nodaway Association (fig. 6)

Extent of the association in the survey area: 8 percent

Component Description

Nodaway and similar soils
Extent: 60 to 75 percent of the association
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Occasional (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: More than 6.7 feet (September)

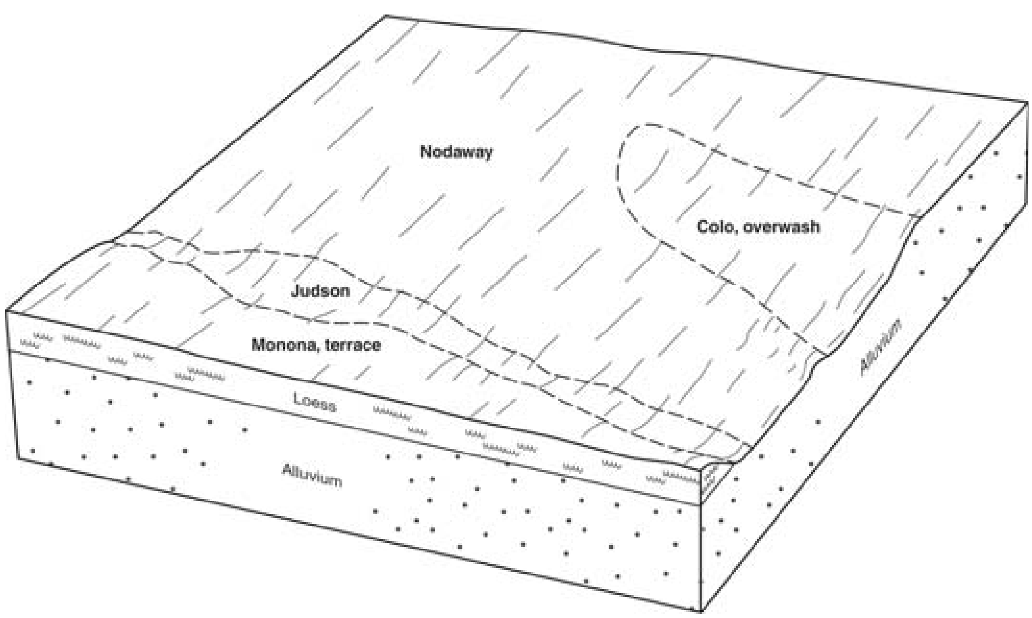

Figure 6.—Typical pattern of soils and parent material in the Nodaway association.

Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Monona, moderately eroded, and similar soils
Extent: 5 to 20 percent of the association

Judson and similar soils
Extent: 5 to 15 percent of the association

Colo, overwash, and similar soils
Extent: 0 to 10 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, Exira silty clay loam, 5 to 9 percent slopes, moderately eroded, is a phase of the Exira 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. Ida-Chute complex, 9 to 14 percent slopes, severely 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.

1C—Ida silt loam, 5 to 9 percent slopes

Component Description

Ida and similar soils
Extent: 90 to 100 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

1C3—Ida silt loam, 5 to 9 percent slopes, severely eroded

Component Description

Ida, severely eroded, and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Summits, shoulders
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None

Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.7 percent

Minor Dissimilar Components

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

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

1D3—Ida silt loam, 9 to 14 percent slopes, severely eroded

Component Description

Ida, severely eroded, and similar soils
Extent: 60 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.7 percent

Minor Dissimilar Components

Monona, moderately eroded, and similar soils
Extent: 5 to 20 percent of the unit

Monona, severely eroded, and similar soils
Extent: 5 to 20 percent of the unit

1E3—Ida silt loam, 14 to 20 percent slopes, severely eroded

Component Description

Ida, severely eroded, and similar soils
Extent: 55 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.7 percent

Minor Dissimilar Components

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

Monona, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

1F3—Ida silt loam, 20 to 30 percent slopes, severely eroded

Component Description

Ida, severely eroded, and similar soils
Extent: 55 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 20 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.7 percent

Minor Dissimilar Components

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

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

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

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

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

Component Description

Judson and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Alluvial fans; drainageways
Position on the landform: Footslopes
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: Well drained
Parent material: Colluvium
Flooding: None

Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

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

Colo, overwash, and similar soils
Extent: 0 to 15 percent of the unit

8C—Judson silty clay loam, 5 to 9 percent slopes

Component Description

Judson and similar soils
Extent: 90 to 100 percent of the unit
Geomorphic setting: Alluvial fans; drainageways
Position on the landform: Footslopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Colo, overwash, and similar soils
Extent: 0 to 10 percent of the unit

9—Marshall silty clay loam, 0 to 2 percent slopes

Component Description

Marshall and similar soils
Extent: 90 to 100 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Summits
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: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.0 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

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

9B—Marshall silty clay loam, 2 to 5 percent slopes

Component Description

Marshall and similar soils
Extent: 100 percent of the unit
Geomorphic setting: Loess hills (fig. 7)
Position on the landform: Summits
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: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.0 inches
Content of organic matter in the upper 10 inches: 3.5 percent

9B2—Marshall silty clay loam, 2 to 5 percent slopes, moderately eroded

Component Description

Marshall, moderately eroded, and similar soils
Extent: 60 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Summits
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: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Marshall soils that are only slightly eroded
Extent: 5 to 20 percent of the unit

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

9C—Marshall silty clay loam, 5 to 9 percent slopes

Component Description

Marshall and similar soils
Extent: 85 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)

Figure 7.—A combination of terraces and contour farming helps to control erosion in an area of Marshall silty clay loam, 2 to 5 percent slopes. These practices also help to prevent siltation in the adjacent drainageways.

Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.0 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

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

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

Component Description

Marshall, moderately eroded, and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Summits, shoulders
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None

Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

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

Marshall soils that are only slightly eroded
Extent: 5 to 20 percent of the unit

9D—Marshall silty clay loam, 9 to 14 percent slopes

Component Description

Marshall and similar soils
Extent: 80 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, backslopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.0 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

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

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

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

Component Description

Marshall, moderately eroded, and similar soils
Extent: 60 to 80 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

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

Marshall soils that are only slightly eroded
Extent: 5 to 15 percent of the unit

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

9E2—Marshall silty clay loam, 14 to 18 percent slopes, moderately eroded

Component Description

Marshall, moderately eroded, and similar soils
Extent: 60 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, backslopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

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

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

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

Marshall soils that are only slightly eroded
Extent: 0 to 10 percent of the unit

9E3—Marshall silty clay loam, 14 to 18 percent slopes, severely eroded

Component Description

Marshall, severely eroded, and similar soils
Extent: 60 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, backslopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Loess
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: 1.3 percent

Minor Dissimilar Components

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

Marshall, moderately eroded, and similar soils
Extent: 5 to 20 percent of the unit

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

10B—Monona silt loam, 2 to 5 percent slopes

Component Description

Monona and similar soils
Extent: 100 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.9 inches
Content of organic matter in the upper 10 inches: 3.4 percent

10B2—Monona silt loam, 2 to 5 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Summits, 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: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Monona soils that are only slightly eroded
Extent: 10 to 20 percent of the unit

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

10C2—Monona silt loam, 5 to 9 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 65 to 85 percent of the unit
Geomorphic setting: Loess hills (fig. 8)
Position on the landform: Backslopes, shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Monona soils that are only slightly eroded
Extent: 5 to 25 percent of the unit

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

10D2—Monona silt loam, 9 to 14 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 40 to 80 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Figure 8.—An area of Monona silt loam, 5 to 9 percent slopes, moderately eroded, that has been planted to native grasses for wildlife habitat.

Minor Dissimilar Components

Ida, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

Monona, severely eroded, and similar soils
Extent: 15 to 25 percent of the unit

Monona soils that are only slightly eroded
Extent: 0 to 10 percent of the unit

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

10D3—Monona silt loam, 9 to 14 percent slopes, severely eroded

Component Description

Monona, severely eroded, and similar soils
Extent: 90 to 100 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None

Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Minor Dissimilar Components

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

10E2—Monona silt loam, 14 to 20 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 30 to 70 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

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

Monona, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

Monona soils that are only slightly eroded
Extent: 5 to 15 percent of the unit

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

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

10E3—Monona silt loam, 14 to 20 percent slopes, severely eroded

Component Description

Monona, severely eroded, and similar soils
Extent: 50 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)

Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Minor Dissimilar Components

Monona, moderately eroded, and similar soils
Extent: 10 to 30 percent of the unit

Ida, severely eroded, and similar soils
Extent: 0 to 15 percent of the unit

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

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

10F2—Monona silt loam, 20 to 30 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 35 to 55 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 20 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Monona, slightly eroded, and similar soils
Extent: 10 to 30 percent of the unit

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

Monona, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

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

10F3—Monona silt loam, 20 to 30 percent slopes, severely eroded

Component Description

Monona, severely eroded, and similar soils
Extent: 50 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 20 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Minor Dissimilar Components

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

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

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

12B—Napier silt loam, 2 to 5 percent slopes

Component Description

Napier and similar soils
Extent: 70 to 95 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Footslopes, toeslopes
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Local alluvium
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

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

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

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

12C—Napier silt loam, 5 to 9 percent slopes

Component Description

Napier and similar soils
Extent: 85 to 100 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Footslopes, toeslopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Local alluvium
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

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

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

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

17B—Napier-Kennebec-Nodaway complex, 2 to 5 percent slopes

Component Description

Napier and similar soils
Extent: 25 to 60 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Footslopes, toeslopes
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Local alluvium
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Kennebec and similar soils
Extent: 20 to 40 percent of the unit
Geomorphic setting: Drainageways
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam

Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: 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: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 13.4 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Nodaway and similar soils
Extent: 10 to 20 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Footslopes, toeslopes
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: 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: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

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

Colo, overwash, and similar soils
Extent: 0 to 10 percent of the unit

22D2—Dow silt loam, 9 to 14 percent slopes, moderately eroded

Component Description

Dow, moderately eroded, and similar soils
Extent: 85 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 0.9 percent

Minor Dissimilar Components

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

22D3—Dow silt loam, 9 to 14 percent slopes, severely eroded

Component Description

Dow, severely eroded, and similar soils
Extent: 85 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 0.9 percent

Minor Dissimilar Components

Monona, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

22E3—Dow silt loam, 14 to 20 percent slopes, severely eroded

Component Description

Dow, severely eroded, and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 0.9 percent

Minor Dissimilar Components

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

Monona, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

26—Kennebec silty clay loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Kennebec and similar soils
Extent: 90 to 100 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Occasional (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 9.1 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Minor Dissimilar Components

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

35D2—Liston-Burchard complex, 9 to 14 percent slopes, moderately eroded

Component Description

Liston, moderately eroded, and similar soils
Extent: 40 to 80 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.9 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Burchard, moderately eroded, and similar soils
Extent: 20 to 60 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till

Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

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

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

35E2—Liston-Burchard complex, 14 to 18 percent slopes, moderately eroded

Component Description

Liston, moderately eroded, and similar soils
Extent: 40 to 80 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes, shoulders (fig. 9)
Slope range: 14 to 18 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.9 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Burchard, moderately eroded, and similar soils
Extent: 20 to 40 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes, shoulders (fig. 9)
Slope range: 14 to 18 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

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

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

Figure 9.—The strongly sloping and moderately steep Liston and Burchard soils are in the foreground and in the distance. Nodaway soils are along the Boyer River in the middle distance.

35F2—Liston-Burchard complex, 18 to 25 percent slopes, moderately eroded

Component Description

Liston, moderately eroded, and similar soils
Extent: 30 to 40 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes
Slope range: 18 to 25 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.9 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Burchard, moderately eroded, and similar soils
Extent: 20 to 40 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes
Slope range: 18 to 25 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.4 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Burchard, severely eroded, and similar soils
Extent: 15 to 25 percent of the unit

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

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

35G—Liston-Burchard complex, 25 to 40 percent slopes

Component Description

Liston and similar soils
Extent: 25 to 50 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes
Slope range: 25 to 40 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.9 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Burchard and similar soils
Extent: 10 to 40 percent of the unit
Geomorphic setting: Hillslopes
Geomorphic component: Head slopes, nose slopes, side slopes
Position on the landform: Backslopes
Slope range: 25 to 40 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.6 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Minor Dissimilar Components

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

Monona, moderately eroded, and similar soils
Extent: 5 to 20 percent of the unit

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

Component Description

Zook and similar soils
Extent: 85 to 95 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: 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: 9.6 inches
Content of organic matter in the upper 10 inches: 5.9 percent

Minor Dissimilar Components

Zook, overwash, and similar soils
Extent: 5 to 15 percent of the unit

54+—Zook silt loam, 0 to 2 percent slopes, occasionally flooded, overwash

Component Description

Zook, overwash, and similar soils
Extent: 85 to 95 percent of the unit
Geomorphic setting: 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: Poorly 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: 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: 5.9 percent

Minor Dissimilar Components

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

59D2—Burchard clay loam, 9 to 14 percent slopes, moderately eroded

Component Description

Burchard, moderately eroded, and similar soils
Extent: 50 to 60 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Burchard, slightly eroded, and similar soils
Extent: 15 to 25 percent of the unit

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

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

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

59E2—Burchard clay loam, 14 to 18 percent slopes, moderately eroded

Component Description

Burchard, moderately eroded, and similar soils
Extent: 50 to 60 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes
Slope range: 14 to 18 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous till
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 9.4 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Burchard, slightly eroded, and similar soils
Extent: 15 to 25 percent of the unit

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

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

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

99C2—Exira silty clay loam, 5 to 9 percent slopes, moderately eroded

Component Description

Exira, moderately eroded, and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Minor Dissimilar Components

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

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

99D2—Exira silty clay loam, 9 to 14 percent slopes, moderately eroded

Component Description

Exira, moderately eroded, and similar soils
Extent: 40 to 60 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Minor Dissimilar Components

Exira, severely eroded, and similar soils
Extent: 10 to 20 percent of the unit

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

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

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

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

99E2—Exira silty clay loam, 14 to 18 percent slopes, moderately eroded

Component Description

Exira, moderately eroded, and similar soils
Extent: 35 to 55 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Minor Dissimilar Components

Exira, severely eroded, and similar soils
Extent: 10 to 40 percent of the unit

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

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

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

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

100B—Monona silty clay loam, 2 to 5 percent slopes

Component Description

Monona and similar soils
Extent: 65 to 90 percent of the unit

Geomorphic setting: Loess hills
Position on the landform: Shoulders, summits
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: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.0 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Minor Dissimilar Components

Monona silty clay loam, moderately eroded, and similar soils
Extent: 10 to 30 percent of the unit

100C2—Monona silty clay loam, 5 to 9 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 40 to 60 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Monona silty clay loam, slightly eroded, and similar soils
Extent: 10 to 50 percent of the unit

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

Monona silty clay loam, severely eroded, and similar soils
Extent: 0 to 40 percent of the unit

100D2—Monona silty clay loam, 9 to 14 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 15 to 55 percent of the unit
Geomorphic setting: Loess hills

Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Monona, severely eroded, and similar soils
Extent: 10 to 30 percent of the unit

Ida, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

Monona silty clay loam, slightly eroded, and similar soils
Extent: 10 to 30 percent of the unit

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

100D3—Monona silty clay loam, 9 to 14 percent slopes, severely eroded

Component Description

Monona, severely eroded, and similar soils
Extent: 35 to 55 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, backslopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.7 percent

Minor Dissimilar Components

Monona, moderately eroded, and similar soils
Extent: 5 to 55 percent of the unit

Ida, severely eroded, and similar soils
Extent: 0 to 15 percent of the unit

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

100E2—Monona silty clay loam, 14 to 20 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 35 to 55 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Monona silty clay loam, severely eroded, and similar soils
Extent: 20 to 40 percent of the unit

Ida, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

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

100E3—Monona silty clay loam, 14 to 20 percent slopes, severely eroded

Component Description

Monona, severely eroded, and similar soils
Extent: 30 to 50 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.8 percent

Minor Dissimilar Components

Monona, moderately eroded, and similar soils
Extent: 20 to 40 percent of the unit

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

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

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

100F2—Monona silty clay loam, 20 to 30 percent slopes, moderately eroded

Component Description

Monona, moderately eroded, and similar soils
Extent: 45 to 65 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 20 to 30 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Monona silty clay loam, severely eroded, and similar soils
Extent: 10 to 40 percent of the unit

Ida, severely eroded, and similar soils
Extent: 0 to 15 percent of the unit

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

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

100F3—Monona silty clay loam, 20 to 30 percent slopes, severely eroded

Component Description

Monona, severely eroded, and similar soils
Extent: 50 to 100 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 20 to 30 percent
Texture of the surface layer: Silty clay loam

Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.7 percent

Minor Dissimilar Components

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

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

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

111D3—Dow-Monona complex, 9 to 14 percent slopes, severely eroded

Component Description

Dow, severely eroded, and similar soils
Extent: 40 to 60 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders, summits
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 0.9 percent

Monona, severely eroded, and similar soils
Extent: 30 to 50 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders, summits
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Minor Dissimilar Components

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

111E3—Dow-Monona complex, 14 to 20 percent slopes, severely eroded

Component Description

Dow, severely eroded, and similar soils
Extent: 40 to 65 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.1 percent

Monona, severely eroded, and similar soils
Extent: 35 to 60 percent of the unit
Geomorphic setting: Loess hills
Geomorphic component: Nose slopes, head slopes, side slopes
Position on the landform: Backslopes, shoulders, summits
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Minor Dissimilar Components

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

125D3—Ida-Chute complex, 9 to 14 percent slopes, severely eroded

Component Description

Ida, severely eroded, and similar soils
Extent: 40 to 75 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Shoulders, backslopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None

Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.8 percent

Chute, severely eroded, and similar soils
Extent: 15 to 60 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Shoulders, backslopes
Slope range: 9 to 14 percent
Texture of the surface layer: Loamy fine sand
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Calcareous eolian deposits
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 4.9 inches
Content of organic matter in the upper 10 inches: 0.8 percent

Minor Dissimilar Components

Monona, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

125E3—Ida-Chute complex, 14 to 20 percent slopes, severely eroded

Component Description

Ida, severely eroded, and similar soils
Extent: 40 to 75 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.6 inches
Content of organic matter in the upper 10 inches: 0.8 percent

Chute, severely eroded, and similar soils
Extent: 15 to 60 percent of the unit
Geomorphic setting: Hillslopes
Position on the landform: Backslopes
Slope range: 14 to 20 percent
Texture of the surface layer: Loamy fine sand
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Calcareous eolian deposits
Flooding: None
Ponding: None

Available water capacity to a depth of 60 inches: 4.9 inches
Content of organic matter in the upper 10 inches: 0.8 percent

Minor Dissimilar Components

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

Monona, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

Component Description

Colo and similar soils
Extent: 70 to 95 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Silty alluvium
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: 12.4 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Colo, overwash, and similar soils
Extent: 0 to 15 percent of the unit

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

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

Component Description

Colo, overwash, and similar soils
Extent: 75 to 100 percent of the unit
Geomorphic setting: 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: Poorly 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: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.1 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

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

212—Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Kennebec and similar soils
Extent: 60 to 80 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Occasional (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 4.3 percent

Minor Dissimilar Components

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

Colo, overwash, and similar soils
Extent: 0 to 15 percent of the unit

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

212+—Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded, overwash

Component Description

Kennebec and similar soils
Extent: 80 to 100 percent of the unit
Geomorphic setting: Flood plains

Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Occasional (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 13.4 inches
Content of organic matter in the upper 10 inches: 4.6 percent

Minor Dissimilar Components

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

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

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

220—Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Nodaway and similar soils
Extent: 65 to 85 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Occasional (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

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

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

266—Smithland silty clay loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Smithland and similar soils
Extent: 75 to 95 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, 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: 12.4 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Kennebec and similar soils
Extent: 2 to 15 percent of the unit

Smithland silt loam, overwash, and similar soils
Extent: 2 to 10 percent of the unit

266+—Smithland silt loam, 0 to 2 percent slopes, occasionally flooded, overwash

Component Description

Smithland, overwash, and similar soils
Extent: 60 to 90 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, 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: 12.4 inches
Content of organic matter in the upper 10 inches: 5.2 percent

Minor Dissimilar Components

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

Smithland silty clay loam and similar soils
Extent: 5 to 15 percent of the unit

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

268D—Knox silt loam, 9 to 14 percent slopes

Component Description

Knox and similar soils
Extent: 75 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes, shoulders
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

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

268E—Knox silt loam, 14 to 20 percent slopes

Component Description

Knox and similar soils
Extent: 70 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes (fig. 10)
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

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

Figure 10.—A wooded area of Knox silt loam, 14 to 20 percent slopes.

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

268F—Knox silt loam, 20 to 30 percent slopes

Component Description

Knox and similar soils
Extent: 70 to 95 percent of the unit
Geomorphic setting: Loess hills
Position on the landform: Backslopes
Slope range: 20 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

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

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

430—Ackmore silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Ackmore and similar soils
Extent: 65 to 85 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Months in which flooding does not occur: January, 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: 12.1 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

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

431B—Judson-Ackmore-Colo, overwash, complex, 2 to 5 percent slopes

Component Description

Judson and similar soils
Extent: 45 to 65 percent of the unit
Geomorphic setting: Alluvial fans; drainageways
Position on the landform: Footslopes
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: Well drained
Parent material: Colluvium
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Ackmore and similar soils
Extent: 15 to 35 percent of the unit
Geomorphic setting: Drainageways
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained

Parent material: Alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Frequent (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.1 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Colo, overwash, and similar soils
Extent: 0 to 20 percent of the unit
Geomorphic setting: Drainageways
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly 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: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.1 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

509B—Marshall silty clay loam, terrace, 2 to 5 percent slopes

Component Description

Marshall, terrace, and similar soils
Extent: 80 to 100 percent of the unit
Geomorphic setting: Stream terraces
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: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.0 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

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

509C—Marshall silty clay loam, terrace, 5 to 9 percent slopes

Component Description

Marshall, terrace, and similar soils
Extent: 75 to 95 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.0 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

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

509C2—Marshall silty clay loam, terrace, 5 to 9 percent slopes, moderately eroded

Component Description

Marshall, terrace, moderately eroded, and similar soils
Extent: 50 to 80 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

Marshall, terrace, slightly eroded, and similar soils
Extent: 0 to 25 percent of the unit

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

509D2—Marshall silty clay loam, terrace, 9 to 14 percent slopes, moderately eroded

Component Description

Marshall, terrace, moderately eroded, and similar soils
Extent: 55 to 75 percent of the unit

Geomorphic setting: Stream terraces
Slope range: 9 to 14 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

Marshall, terrace, slightly eroded, and similar soils
Extent: 0 to 25 percent of the unit

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

509E2—Marshall silty clay loam, terrace, 14 to 20 percent slopes, moderately eroded

Component Description

Marshall, terrace, moderately eroded, and similar soils
Extent: 50 to 80 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 14 to 20 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

Marshall, terrace, slightly eroded, and similar soils
Extent: 10 to 30 percent of the unit

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

510—Monona silt loam, terrace, 0 to 2 percent slopes

Component Description

Monona, terrace, and similar soils
Extent: 100 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess

Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.9 inches
Content of organic matter in the upper 10 inches: 3.4 percent

510B—Monona silt loam, terrace, 2 to 5 percent slopes

Component Description

Monona, terrace, and similar soils
Extent: 50 to 75 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.9 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

Monona, terrace, moderately eroded, and similar soils
Extent: 25 to 50 percent of the unit

510C2—Monona silt loam, terrace, 5 to 9 percent slopes, moderately eroded

Component Description

Monona, terrace, moderately eroded, and similar soils
Extent: 65 to 85 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Monona, terrace, slightly eroded, and similar soils
Extent: 10 to 20 percent of the unit

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

510D2—Monona silt loam, terrace, 9 to 14 percent slopes, moderately eroded

Component Description

Monona, terrace, moderately eroded, and similar soils
Extent: 65 to 85 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Monona, terrace, severely eroded, and similar soils
Extent: 5 to 25 percent of the unit

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

510E2—Monona silt loam, terrace, 14 to 20 percent slopes, moderately eroded

Component Description

Monona, terrace, moderately eroded, and similar soils
Extent: 65 to 85 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 14 to 20 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Monona, terrace, severely eroded, and similar soils
Extent: 5 to 25 percent of the unit

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

630—Danbury silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Danbury and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt 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: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Minor Dissimilar Components

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

Colo, overwash, and similar soils
Extent: 0 to 10 percent of the unit

670—Rawles silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Rawles and similar soils
Extent: 65 to 95 percent of the unit
Geomorphic setting: 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: Calcareous alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Occasional (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.5 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

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

Smithland, overwash, and similar soils
Extent: 0 to 10 percent of the unit

700—Monona silty clay loam, terrace, 0 to 2 percent slopes

Component Description

Monona, terrace, and similar soils
Extent: 100 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.9 inches
Content of organic matter in the upper 10 inches: 3.4 percent

700B—Monona silty clay loam, terrace, 2 to 5 percent slopes

Component Description

Monona, terrace, and similar soils
Extent: 70 to 80 percent of the unit
Geomorphic setting: Stream terraces
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: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.9 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

Monona, terrace, moderately eroded, and similar soils
Extent: 20 to 30 percent of the unit

700C2—Monona silty clay loam, terrace, 5 to 9 percent slopes, moderately eroded

Component Description

Monona, terrace, moderately eroded, and similar soils
Extent: 30 to 70 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Monona, terrace, slightly eroded, and similar soils
Extent: 10 to 50 percent of the unit

Monona, terrace, severely eroded, and similar soils
Extent: 5 to 25 percent of the unit

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

700D2—Monona silty clay loam, terrace, 9 to 14 percent slopes, moderately eroded

Component Description

Monona, terrace, moderately eroded, and similar soils
Extent: 50 to 70 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 9 to 14 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Monona, terrace, slightly eroded, and similar soils
Extent: 15 to 40 percent of the unit

Monona, terrace, severely eroded, and similar soils
Extent: 5 to 15 percent of the unit

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

717D—Napier-Gullied land complex, 5 to 14 percent slopes

Component Description

Napier and similar soils
Extent: 30 to 70 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Toeslopes
Slope range: 5 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Local alluvium
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Gullied land
Extent: 25 to 45 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Toeslopes, footslopes
Slope range: 5 to 14 percent
Months in which flooding does not occur: January, December
Highest frequency of flooding: Frequent (February, March, April, May, June, July, August, September, October, November)
Ponding: None

Minor Dissimilar Components

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

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

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

Component Description

Hawick and similar soils
Extent: 75 to 95 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 9 to 14 percent
Texture of the surface layer: Gravelly sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Sandy outwash sediments
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 3.1 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Minor Dissimilar Components

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

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

740E—Hawick gravelly sandy loam, 14 to 18 percent slopes

Component Description

Hawick and similar soils
Extent: 75 to 100 percent of the unit
Geomorphic setting: Stream terraces

Slope range: 14 to 18 percent
Texture of the surface layer: Gravelly sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Sandy outwash sediments
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 3.1 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Minor Dissimilar Components

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

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

740F—Hawick gravelly sandy loam, 18 to 25 percent slopes

Component Description

Hawick and similar soils
Extent: 75 to 100 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 18 to 25 percent
Texture of the surface layer: Gravelly sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Sandy outwash sediments
Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 3.1 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Minor Dissimilar Components

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

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

980C—Judson-Gullied land complex, 5 to 9 percent slopes

Component Description

Judson and similar soils
Extent: 40 to 70 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Footslopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium

Flooding: None
Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Gullied land
Extent: 20 to 45 percent of the unit
Geomorphic setting: Drainageways
Position on the landform: Toeslopes, footslopes
Slope range: 5 to 9 percent
Months in which flooding does not occur: January, December
Highest frequency of flooding: Frequent (February, March, April, May, June, July, August, September, October, November)
Ponding: None

Minor Dissimilar Components

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

1220—Nodaway silt loam, channeled, 0 to 2 percent slopes, frequently flooded

Component Description

Nodaway, channeled, frequently flooded, and similar soils
Extent: 70 to 90 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: 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: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 13.2 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

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

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

5010—Pits, sand and gravel

Component Description

Pits, sand and gravel
Definition: This map unit consists of areas from which sand and gravel have been removed.

Extent: 100 percent of the unit
Ponding: None

5040—Udorthents, loamy

Component Description

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

5080—Udorthents, sanitary landfill

Component Description

Udorthents
Extent: 100 percent of the unit
Ponding: None

AW—Animal waste lagoon

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

SL—Sewage lagoon

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

W—Water

- This map unit consists of natural bodies of water.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludolls (*Hapl*, meaning minimal horizonation, plus *udoll*, the suborder of the Mollisols that has a udic moisture regime).

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

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, superactive, mesic Typic Hapludolls.

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

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

Soil Series and Their Morphology

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

Ackmore Series

Typical Pedon

Ackmore silt loam, 0 to 2 percent slopes, on a nearly level flood plain, in a pastured area; in Warren County, Iowa; about 2 miles southeast of Bevington; about 2,230 feet west and 275 feet south of the northeast corner of sec. 5, T. 75 N., R. 25 W.; USGS St. Charles topographic quadrangle; lat. 41 degrees 20 minutes 12 seconds N. and long. 93 degrees 45 minutes 34 seconds W., NAD 83:

Ap—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; moderately acid; abrupt smooth boundary.

C—6 to 25 inches; stratified very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) silt loam; massive with weak thin alluvial stratification; friable; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; clear smooth boundary.

Ab1—25 to 30 inches; black (10YR 2/1) silty clay loam; weak fine subangular blocky structure parting to weak fine granular; friable; moderately acid; clear smooth boundary.

Ab2—30 to 44 inches; black (10YR 2/1) silty clay loam; weak medium prismatic structure parting to moderate very fine and fine subangular blocky; friable; few fine dark iron-manganese masses; slightly acid; clear smooth boundary.

Ab3—44 to 60 inches; black (10YR 2/1) silty clay loam; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few fine dark iron-manganese masses; neutral.

Range in Characteristics

Depth to buried horizons: 20 to 40 inches

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

C horizon:
Hue—10YR
Value—2 to 5
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

Ab horizon:
Hue—10YR or N
Value—2 to 4
Chroma—0 to 2
Texture—silty clay loam or silt loam
Reaction—moderately acid to slightly alkaline

Bb horizon (if it occurs):
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—silty clay loam
Reaction—slightly acid to slightly alkaline

Adair Series

Typical Pedon

Adair clay loam, in an area of Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded, in a cultivated field in the uplands; in Shelby County, Iowa; 2,100 feet east and 75 feet north of the southwest corner of sec. 15, T. 80 N., R. 37 W.; USGS Jacksonville topographic quadrangle; lat. 41 degrees 43 minutes 55.3 seconds N. and long. 95 degrees 08 minutes 38.9 seconds W., NAD 83:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many very fine roots; common very fine tubular pores; few fine prominent yellowish brown (10YR 5/6) iron masses; neutral; clear smooth boundary.

2Bt1—6 to 18 inches; strong brown (7.5YR 4/6) clay loam; weak fine subangular blocky structure; firm; few very fine roots; many very fine tubular pores; few prominent dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; slightly acid; gradual smooth boundary.

2Bt2—18 to 33 inches; dark yellowish brown (10YR 4/6) and yellowish red (5YR 4/6) clay; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; very firm; few very fine roots; many very fine tubular pores; few prominent dark grayish brown (10YR 4/2) clay films on faces of peds; common fine prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; moderately acid; gradual smooth boundary.

2Bt3—33 to 56 inches; dark yellowish brown (10YR 4/6) clay loam; weak fine and medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; many very fine tubular pores; few prominent dark grayish brown (10YR 4/2) clay films on faces of peds; few fine prominent black (10YR 2/1) manganese masses; common fine and medium prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; slightly acid; gradual smooth boundary.

2BC—56 to 69 inches; dark yellowish brown (10YR 4/6) clay loam; weak medium prismatic structure; friable; many very fine tubular pores; common fine prominent black (10YR 2/1) manganese masses; many medium prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; slightly acid; gradual smooth boundary.

2C—69 to 80 inches; dark yellowish brown (10YR 4/6) clay loam; massive; friable; many very fine tubular pores; few fine prominent black (10YR 2/1) manganese masses; many medium and coarse prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; slightly acid.

Range in Characteristics

Ap or A horizon:
Hue—7.5YR or 10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam, clay loam, or silt loam
Reaction—moderately acid to neutral

2Bt horizon:
Hue—2.5YR to 10YR
Value—3 to 5
Chroma—3 to 6
Texture—clay or clay loam
Reaction—strongly acid to slightly acid

2BC horizon:
Hue—2.5YR to 10YR
Value—3 to 5
Chroma—3 to 6
Texture—clay loam
Reaction—moderately acid to slightly alkaline

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

Taxadjunct features: The typical pedon does not have a mollic epipedon. This soil is classified as a fine, smectitic, mesic Oxyaquic Vertic Hapludalf.

Burchard Series

Typical Pedon

Burchard clay loam (fig. 11), 14 to 18 percent slopes, moderately eroded, in a pasture in the uplands; in Crawford County, Iowa; 500 feet south and 140 feet west of the northeast corner of sec. 29, T. 85 N., R. 38 W.; USGS Kiron topographic quadrangle; lat. 42 degrees 09 minutes 07 seconds N. and long. 95 degrees 17 minutes 06 seconds W., NAD 83:

A1—0 to 6 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; few fine and very fine roots; many very fine and fine tubular pores; about 2 percent rock fragments; slightly acid; clear smooth boundary.

A2—6 to 12 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; few fine and very fine roots; many very fine and fine tubular pores; common distinct black (10YR 2/1) organic coats on faces of peds; neutral; clear smooth boundary.

Bt—12 to 20 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine and very fine roots; many very fine and fine tubular pores; few distinct clay films on faces of peds; few distinct very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) organic coats on faces of peds; about 2 percent rock fragments; neutral; clear smooth boundary.

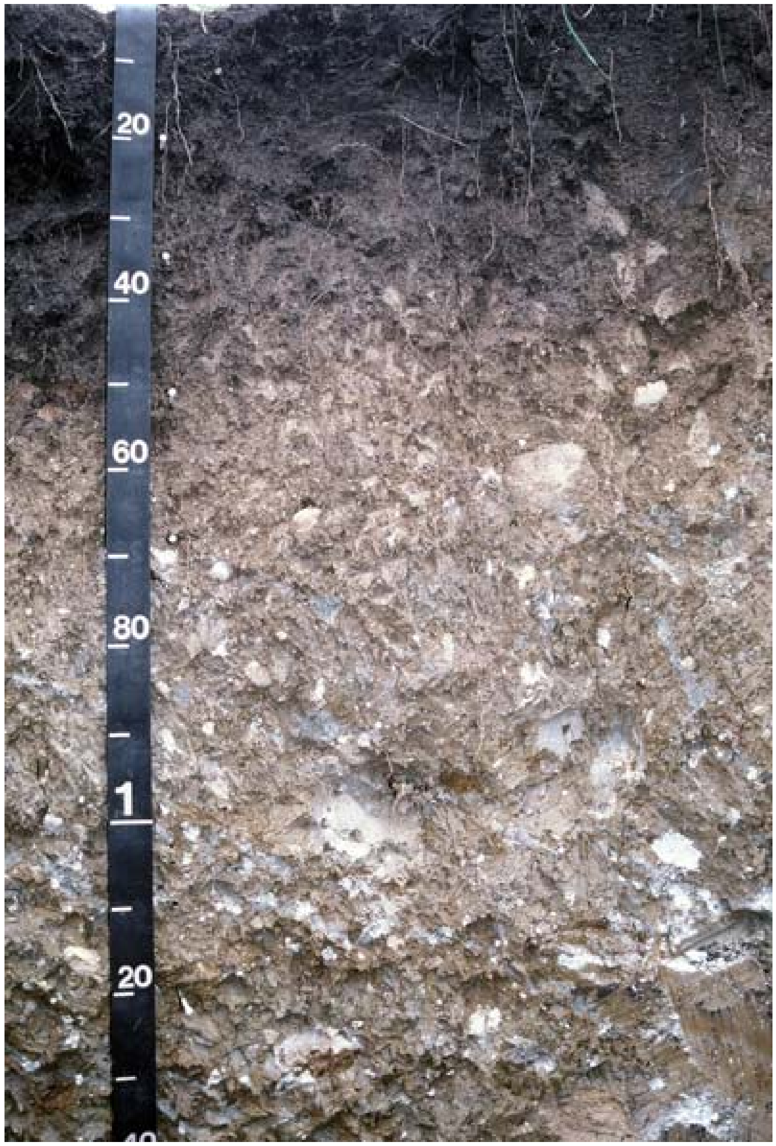

Figure 11.—Profile of Burchard clay loam.

Btk1—20 to 28 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; friable; few fine and very fine roots; common very fine and fine tubular pores; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine irregular very pale brown (10YR 8/2) calcium carbonate concretions; about 2 percent rock fragments; strongly effervescent; slightly alkaline; clear smooth boundary.

Btk2—28 to 43 inches; yellowish brown (10YR 5/6) clay loam; moderate fine subangular blocky structure; firm; few very fine roots; common very fine and fine tubular pores; few distinct yellowish brown (10YR 5/4) clay films on faces of peds; few fine irregular very pale brown (10YR 8/2) calcium carbonate concretions; about 2 percent rock fragments; strongly effervescent; slightly alkaline; gradual smooth boundary.

Btk3—43 to 53 inches; about 60 percent yellowish brown (10YR 5/4) and 40 percent grayish brown (2.5Y 5/2) clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine and fine tubular pores;

few distinct yellowish brown (10YR 5/4) clay films on faces of peds; few fine irregular very pale brown (10YR 8/2) calcium carbonate concretions; about 2 percent rock fragments; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk—53 to 80 inches; mottled yellowish brown (10YR 5/4) and grayish brown (2.5Y 5/2) clay loam; moderate fine prismatic structure; firm; few fine irregular very pale brown (10YR 8/2) calcium carbonate concretions; about 2 percent rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 30 inches

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

Bt horizon:
Hue—10YR
Value—3 to 6
Chroma—2 to 6
Texture—clay loam
Reaction—slightly acid or neutral

Btk horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—2 to 6
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Bk horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—2 to 6
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

Chute Series

Typical Pedon

Chute loamy fine sand, on an east-facing, convex slope of 35 percent; in a wooded area; in Peoria County, Illinois; about 6$^{1}/_{2}$ miles west of Peoria; 300 feet east and 1,400 feet south of the northwest corner of sec. 28, T. 9 N., R. 7 E.; USGS Peoria West topographic quadrangle; lat. 40 degrees 44 minutes 10 seconds N. and long. 89 degrees 43 minutes 03 seconds W.

A—0 to 4 inches; dark brown (10YR 3/3) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; few very fine roots; few brown (10YR 4/3) soil fragments and wormcasts; slightly alkaline; clear wavy boundary.

AC—4 to 11 inches; dark yellowish brown (10YR 4/4) fine sand; weak medium subangular blocky structure; very friable; few very fine roots; common distinct dark brown (10YR 3/3) organic coatings on faces of peds; slightly effervescent; slightly alkaline; clear smooth boundary.

C—11 to 60 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; strongly effervescent; moderately alkaline.

Range in Characteristics

A or Ap horizon:
Hue—10YR
Value—3 to 5; 3 to 6 in eroded areas
Chroma—2 or 3; 3 or 4 in eroded areas
Texture—loamy fine sand, fine sandy loam, fine sand, or sand
Reaction—neutral to moderately alkaline

AC horizon:
Hue—10YR
Value—3 to 6
Chroma—3 to 6
Texture—loamy fine sand or fine sand
Reaction—neutral to moderately alkaline

C horizon:
Hue—10YR
Value—5 or 6
Chroma—3 to 6
Texture—fine sand, loamy fine sand, or sand
Reaction—slightly alkaline or moderately alkaline

Colo Series

Typical Pedon

Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; in Crawford County, Iowa; 300 feet east and 2,540 feet north of the southwest corner of sec. 1, T. 84 N., R. 37 W.; USGS Arcadia topographic quadrangle; lat. 42 degrees 06 minutes 54.9 seconds N. and long. 95 degrees 06 minutes 34.7 seconds W., NAD 83:

Ap—0 to 6 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine and medium granular structure; friable; many fine roots; many fine tubular pores; slightly acid; abrupt smooth boundary.

A1—6 to 14 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure parting to weak fine and medium granular; friable; many fine roots; many fine tubular pores; neutral; gradual smooth boundary.

A2—14 to 26 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure; friable; many fine roots; many fine tubular pores; neutral; gradual smooth boundary.

A3—26 to 37 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; common fine roots; many fine tubular pores; neutral; diffuse smooth boundary.

A4—37 to 48 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; few fine roots; few fine tubular pores; neutral; diffuse smooth boundary.

Bg—48 to 62 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak coarse prismatic structure parting to weak medium subangular blocky; friable; few fine roots; few fine tubular pores; common distinct black (10YR 2/1) coats on faces of prisms; neutral; diffuse smooth boundary.

Cg—62 to 80 inches; very dark gray (10YR 3/1) silty clay loam; massive; friable; neutral.

Range in Characteristics

Thickness of the mollic epipedon: More than 36 inches
Depth to carbonates: More than 60 inches

Ap or A horizon:
Hue—10YR or N; 10YR in overwash phase
Value—2 or 3; 3 to 5 in overwash phase
Chroma—0 to 2; 1 or 2 in overwash phase
Texture—silty clay loam; silt loam or silty clay loam in overwash phase
Reaction—moderately acid to neutral; slightly acid to moderately alkaline in overwash phase

Bg horizon:
Hue—10YR or 2.5Y
Value—2 to 4
Chroma—1
Texture—silty clay loam
Reaction—moderately acid to neutral

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

Danbury Series

Typical Pedon

Danbury silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; in Woodbury County, Iowa; 1,700 feet north and 500 feet west of the southeast corner of sec. 23, T. 88 N., R. 42 W.; USGS Cushing topographic quadrangle; lat. 42 degrees 25 minutes 34.1 seconds N. and long. 95 degrees 41 minutes 27.2 seconds W., NAD 83:

Ap—0 to 7 inches; about 95 percent very dark grayish brown (10YR 3/2) and 5 percent dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; common fine roots; many very fine pores; moderately acid; abrupt smooth boundary.

C1—7 to 15 inches; about 90 percent very dark grayish brown (10YR 3/2) and 10 percent dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; massive with weak thin alluvial stratification; friable; few very fine roots; many very fine pores; neutral; clear smooth boundary.

C2—15 to 25 inches; about 95 percent very dark grayish brown (10YR 3/2) and 5 percent dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; massive with weak thin alluvial stratification; friable; few very fine roots; many very fine and fine tubular pores; neutral; clear smooth boundary.

C3—25 to 32 inches; about 95 percent very dark grayish brown (10YR 3/2) and 5 percent dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; massive with weak thin alluvial stratification; friable; few very fine roots; many very fine and fine tubular pores; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; neutral; abrupt wavy boundary.

2Ab1—32 to 43 inches; black (10YR 2/1) silty clay loam; weak very fine subangular blocky structure; friable; many very fine and fine tubular pores; common fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; neutral; gradual smooth boundary.

2Ab2—43 to 53 inches; black (10YR 2/1) silty clay loam; weak very fine and fine subangular blocky structure; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral; gradual smooth boundary.

2Ab3—53 to 64 inches; black (10YR 2/1) silty clay loam, weak fine subangular blocky structure; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral; clear smooth boundary.

2Bwb1—64 to 71 inches; very dark gray (10YR 3/1) silty clay loam; weak very fine prismatic structure parting to weak fine subangular blocky; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral; clear smooth boundary.

2Bwb2—71 to 80 inches; very dark gray (10YR 3/1) silty clay loam; moderate very fine prismatic structure parting to weak fine subangular blocky; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral.

Range in Characteristics

Depth to carbonates: More than 52 inches
Depth to buried horizon: 20 to 40 inches

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

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

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

2Bwb horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 to 3
Texture—silty clay loam or silt loam
Reaction—moderately acid to neutral

Deloit Series

Typical Pedon

Deloit loam, 5 to 9 percent slopes, in a pastured area in the uplands; in Woodbury County, Iowa; 2,050 feet west and 900 feet north of the southeast corner of sec. 1, T. 89 N., R. 42 W.; USGS Washta topographic quadrangle; lat. 42 degrees 32 minutes 59 seconds N. and long. 95 degrees 44 minutes 56.8 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; common fine tubular pores; neutral; abrupt smooth boundary.

A1—8 to 18 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak very fine subangular blocky structure parting to weak very fine and fine granular; friable; few very fine and fine roots; common very fine and fine tubular pores; many distinct black (10YR 2/1) organic coats on vertical faces of peds; slightly acid; gradual smooth boundary.

A2—18 to 30 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak very fine and fine subangular blocky structure; friable; few very fine and fine roots; common very fine and fine tubular pores; many distinct black (10YR 2/1) organic coats on vertical faces of peds; slightly acid; gradual smooth boundary.

A3—30 to 40 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine subangular blocky structure; friable; few very fine and fine roots; common very fine and fine tubular pores; many distinct very dark brown (10YR 2/2) organic coats on vertical faces of peds; slightly acid; clear smooth boundary.

AB—40 to 50 inches; dark brown (10YR 3/3) clay loam, dark grayish brown (10YR 4/2) dry; weak very fine prismatic structure parting to weak fine subangular blocky; friable; few very fine and fine roots; common very fine and fine tubular pores; many distinct very dark grayish brown (10YR 3/2) organic coats on vertical faces of peds; slightly acid; gradual smooth boundary.

Bw1—50 to 61 inches; brown (10YR 4/3) clay loam; weak fine prismatic structure parting to weak fine and medium subangular blocky; friable; common very fine and fine tubular pores; many distinct very dark grayish brown (10YR 3/2) organic coats on vertical faces of peds; slightly acid; gradual smooth boundary.

Bw2—61 to 69 inches; brown (10YR 4/3) clay loam; weak fine prismatic structure parting to weak medium subangular blocky; friable; common very fine and fine tubular pores; common distinct very dark grayish brown (10YR 3/2) organic coats on vertical faces of peds; slightly acid; gradual smooth boundary.

Bw3—69 to 80 inches; brown (10YR 4/3) loam; weak medium prismatic structure parting to weak coarse subangular blocky; friable; common very fine and fine tubular pores; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 55 inches
Depth to carbonates: More than 50 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

AB horizon:
Hue—10YR
Value—3
Chroma—2 or 3
Texture—loam or clay loam
Reaction—slightly acid to slightly alkaline

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

Bt or Bk horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—loam, clay loam, or silt loam
Reaction—slightly acid to slightly alkaline

Dow Series

Typical Pedon

Dow silt loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field in the uplands; in Crawford County, Iowa; 2,525 feet north and 410 feet west of the southeast corner of sec. 31, T. 82 N., R. 40 W.; USGS Dunlap NE topographic quadrangle; lat. 41 degrees 52 minutes 13.6 seconds N. and long. 95 degrees 32 minutes 21.9 seconds W., NAD 83:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to weak fine granular; friable; common fine and very fine roots; few fine and very fine tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—6 to 15 inches; grayish brown (2.5Y 5/2) silt loam; massive; very friable; common fine and very fine roots; few fine and very fine tubular pores; few distinct brown (10YR 4/3) organic stains along cleavage planes; few fine and medium prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—15 to 21 inches; light brownish gray (2.5Y 6/2) silt loam; massive; very friable; few very fine roots; few very fine tubular pores; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—21 to 80 inches; light brownish gray (2.5Y 6/2) silt loam; massive; very friable; few very fine tubular pores; few fine prominent strong brown (7.5YR 5/6) and reddish brown (5YR 4/4) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Less than 10 inches

A horizon:
Hue—10YR
Value—2 or 3

Chroma—2
Texture—silt loam
Reaction—neutral to moderately alkaline

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

C horizon:
Hue—10YR to 5Y
Value—5 or 6
Chroma—2
Texture—silt loam
Reaction—moderately alkaline or slightly alkaline
Note—redoximorphic features are considered relict and include high-chroma concentrations, pipestems, or concretions that are high in iron.

Exira Series

Typical Pedon

Exira silty clay loam (fig. 12), 5 to 9 percent slopes, moderately eroded, in a cultivated field in the uplands; in Crawford County, Iowa; 1,550 feet north and 650 feet east of the southwest corner of sec. 12, T. 83 N., R. 37 W.; USGS Arcadia topographic quadrangle; lat. 42 degrees 47.3 seconds N. and long. 95 degrees 06 minutes 30.4 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; common fine and very fine roots; common fine and very fine tubular pores; slightly acid; abrupt smooth boundary.

A—7 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam; few brown (10YR 4/3) mixings in the lower part; dark grayish brown (10YR 4/2) dry; moderate medium and fine subangular blocky structure; friable; common fine and very fine roots; common fine and very fine tubular pores; slightly acid; clear smooth boundary.

Bw1—12 to 17 inches; brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable; few fine and very fine roots; few fine and very fine tubular pores; many prominent very dark grayish brown (10YR 3/2) organic coats on faces of peds; slightly acid; clear smooth boundary.

Bw2—17 to 24 inches; brown (10YR 4/3) silty clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; few very fine tubular pores; common fine distinct dark yellowish brown (10YR 4/6) redoximorphic concentrations; slightly acid; clear smooth boundary.

Bw3—24 to 31 inches; brown (10YR 4/3) silty clay loam; moderate medium prismatic structure; friable; few very fine roots; few very fine tubular pores; common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; common fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid; clear smooth boundary.

Bw4—31 to 43 inches; brown (10YR 4/3) silty clay loam; weak medium prismatic structure; friable; few very fine roots; few very fine tubular pores; many fine faint light brownish gray (10YR 6/2) redoximorphic depletions; common fine distinct yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5 YR 5/6) redoximorphic concentrations; slightly acid; gradual smooth boundary.

Figure 12.—Profile of Exira silty clay loam.

C1—43 to 56 inches; about 60 percent yellowish brown (10YR 5/4) and 40 percent light brownish gray (2.5Y 6/2) silty clay loam; massive; friable; few very fine roots;

few very fine tubular pores; common fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; neutral; gradual smooth boundary.

C2—56 to 66 inches; about 55 percent brownish gray (2.5Y 6/2) and 45 percent yellowish brown (10YR 5/4) silty clay loam; massive; friable; few very fine tubular pores; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) redoximorphic concentrations; neutral; diffuse smooth boundary.

C3—66 to 75 inches; about 70 percent brownish gray (2.5Y 6/2) and 30 percent yellowish brown (10YR 5/4) silty clay loam; massive; friable; few very fine tubular pores; common fine prominent strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) redoximorphic concentrations; neutral; diffuse smooth boundary.

C4—75 to 80 inches; about 70 percent brownish gray (2.5Y 6/2) and 30 percent yellowish brown (10YR 5/4) silt loam; massive; friable; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 16 inches
Depth to carbonates: More than 40 inches

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

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—3
Texture—silty clay loam or silt loam
Reaction—moderately acid or slightly acid
Note—redoximorphic features are considered relict

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—silt loam or silty clay loam
Reaction—slightly acid or neutral
Note—redoximorphic features are considered relict

Taxadjunct features: The Exira soils in Crawford County are taxadjuncts because the surface layer does not meet the thickness requirements for a Mollisol.

Hawick Series

Typical Pedon

Hawick gravelly sandy loam, 14 to 18 percent slopes, in a cultivated field in the uplands; in Crawford County, Iowa; 2,480 feet north and 320 feet west of the southeast corner of sec. 2, T. 83 N., R. 38 W.; USGS Vail topographic quadrangle; lat. 42 degrees 01 minute 50 seconds N. and long. 95 degrees 13 minutes 42.4 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; very friable; many very fine and fine roots; many very fine and fine interstitial pores;

about 16 percent rock fragments; strongly effervescent; slightly alkaline; abrupt smooth boundary.

AC—7 to 10 inches; dark brown (10YR 3/3) gravelly loamy coarse sand; single grain; loose; common very fine roots; about 30 percent rock fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—10 to 30 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; few very fine roots; common fine very pale brown (10YR 8/2) carbonate coats on rock fragments below a depth of 22 inches; about 27 percent rock fragments; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—30 to 80 inches; yellowish brown (10YR 5/4) coarse sand; single grain; loose; common fine very pale brown (10YR 8/2) carbonate coats on rock fragments; about 10 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 30 inches
Thickness of the mollic epipedon: 7 to 16 inches

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

Bw horizon (if it occurs):
Hue—7.5YR, 10YR, or 2.5Y
Value—3 to 5
Chroma—3 or 4
Texture—gravelly loamy coarse sand or coarse sand
Reaction—slightly acid to slightly alkaline

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

Ida Series

Typical Pedon

Ida silt loam, 5 to 9 percent slopes, severely eroded, in a cultivated field in the uplands; in Crawford County, Iowa; 150 feet north and 2,400 feet west of the southeast corner of sec. 7, T. 85 N., R. 41 W.; USGS Danbury topographic quadrangle; lat. 42 degrees 10 minutes 57.6 seconds N. and long. 95 degrees 39 minutes 41.3 seconds W., NAD 83:

Ap—0 to 6 inches; about 90 percent brown (10YR 4/3) and 10 percent brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; common very fine and fine roots; few tubular pores; dark brown (10YR 3/3) organic coats on faces of peds; few fine and medium irregular carbonate concretions; few fine faint brown (7.5YR 4/4) relict redoximorphic concentrations; strongly effervescent; slightly alkaline; clear smooth boundary.

C1—6 to 12 inches; brown (10YR 5/3) silt loam; massive; friable; few fine roots; common fine tubular pores; dark brown (10YR 3/3) organic coats; common fine and medium irregular carbonate concretions; few fine faint brown (7.5YR 4/4) relict redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—12 to 18 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few fine roots; common fine tubular pores; common fine and medium irregular carbonate concretions; few fine irregular very dark brown (7.5YR 2/2) masses of manganese; few fine distinct grayish brown (10YR 5/2) relict redoximorphic depletions; few fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—18 to 25 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few fine roots; common fine tubular pores; few fine irregular carbonate concretions; few fine irregular very dark brown (7.5YR 2/2) masses of manganese; common coarse distinct light brownish gray (10YR 6/2) relict redoximorphic depletions; common coarse distinct yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

C4—25 to 31 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few fine roots; common fine tubular pores; few fine irregular carbonate concretions; few fine irregular very dark brown (7.5YR 2/2) masses of manganese; common coarse distinct light brownish gray (10YR 6/2) relict redoximorphic depletions; common coarse distinct yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

C5—31 to 46 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; common fine tubular pores; few fine irregular carbonate concretions; few fine irregular very dark brown (7.5YR 2/2) masses of manganese; common coarse distinct light brownish gray (2.5Y 6/2) relict redoximorphic depletions; common coarse distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

C6—46 to 71 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; common fine tubular pores; few fine irregular dark brown (7.5YR 3/2) masses of manganese; common coarse distinct light brownish gray (2.5Y 6/2) relict redoximorphic depletions; common coarse distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

C7—71 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few fine irregular dark brown (7.5YR 3/2) masses of manganese; common coarse distinct light brownish gray (2.5Y 6/2) relict redoximorphic depletions; common coarse distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Note: The redoximorphic features described in this pedon are considered relict.

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

C horizon:
Hue—10YR or 2.5Y
Value—4 or 5

Chroma—3 to 6
Texture—silt loam
Reaction—slightly alkaline or moderately alkaline

Judson Series

Typical Pedon

Judson silty clay loam, 2 to 5 percent slopes, in a cultivated field in an upland drainageway; in Crawford County, Iowa; 1,850 feet north and 220 feet west of the southeast corner of sec. 22, T. 82 N., R. 38 W.; USGS Manilla topographic quadrangle; lat. 41 degrees 53 minutes 52.3 seconds N. and long. 95 degrees 14 minutes 52.5 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to moderate fine granular; friable; many very fine and fine roots; common very fine tubular pores; many distinct black (10YR 2/1) organic stains on faces of peds and in pores; moderately acid; abrupt smooth boundary.

A1—9 to 20 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine and medium subangular blocky structure parting to weak fine granular; friable; many very fine roots; many very fine and fine tubular pores; many distinct black (10YR 2/1) organic stains on faces of peds and in pores; slightly acid; gradual smooth boundary.

A2—20 to 29 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine and medium subangular blocky structure; friable; many very fine roots; many very fine and fine tubular pores; many distinct black (10YR 2/1) organic stains on faces of peds and in pores; slightly acid; gradual smooth boundary.

AB—29 to 37 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium subangular blocky structure; friable; many very fine roots; many very fine and fine tubular pores; common distinct very dark brown (10YR 2/2) organic stains on faces of peds and in pores; neutral; gradual smooth boundary.

Bw1—37 to 52 inches; brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; friable; common very fine roots; many very fine and fine tubular pores; many distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds and in pores; neutral; gradual smooth boundary.

Bw2—52 to 61 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; common very fine roots; many very fine and fine tubular pores; neutral; gradual smooth boundary.

BC—61 to 76 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak coarse prismatic structure parting to weak medium subangular blocky; friable; many very fine and fine tubular pores; neutral; gradual smooth boundary.

C—76 to 80 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; friable; many very fine and fine tubular pores; few fine irregular very dark brown (10YR 2/2) masses of manganese; few fine distinct (10YR 5/2) redoximorphic depletions; neutral.

Range in Characteristics

Depth to carbonates: More than 60 inches
Thickness of the mollic epipedon: 32 to 52 inches

Ap or A horizon:
Hue—10YR

Value—2
Chroma—1 or 2
Texture—silty clay loam
Reaction—moderately acid to neutral

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

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

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

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

Kennebec Series

Typical Pedon

Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; in Crawford County, Iowa; 2,110 feet north and 62 feet east of the southwest corner of sec. 27, T. 82 N., R. 41 W.; USGS Dunlap NE topographic quadrangle; lat. 41 degrees 52 minutes 59.5 seconds N. and long. 95 degrees 36 minutes 54.3 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; common fine and very fine roots; few fine and very fine tubular pores; slightly acid; clear smooth boundary.

A1—8 to 18 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common fine and very fine roots; common fine tubular pores; slightly acid; diffuse smooth boundary.

A2—18 to 32 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure; friable; common fine and very fine roots; common fine and medium tubular pores; slightly acid; diffuse smooth boundary.

A3—32 to 41 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; friable; few very fine roots; few fine and medium tubular pores; many large wormholes; slightly acid; diffuse smooth boundary.

AC—41 to 54 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; few very fine roots; few very fine tubular pores; slightly acid; diffuse smooth boundary.

C1—54 to 63 inches; very dark grayish brown (10YR 3/2) silt loam; massive; friable; few fine tubular pores; few fine rounded very dark brown (7.5YR 2.5/2) iron and manganese concretions; common medium faint dark brown (10YR 3/3) and common fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; few fine faint grayish brown (10YR 5/2) redoximorphic depletions; slightly acid; diffuse smooth boundary.

C2—63 to 72 inches; very dark grayish brown (10YR 3/2) silt loam; massive; friable; few fine tubular pores; common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; slightly acid; diffuse smooth boundary.

C3—72 to 80 inches; very dark grayish brown (10YR 3/2) silt loam; massive; friable; few fine tubular pores; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid.

Range in Characteristics

Depth to carbonates: More than 80 inches
Thickness of the mollic epipedon: More than 40 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3; 3 or 4 in the overwash phase
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

AC horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam
Reaction—slightly acid or neutral

C horizon:
Hue—10YR or 2.5Y
Value—2 to 4
Chroma—1 or 2
Texture—silt loam
Reaction—slightly acid or neutral

Knox Series

Typical Pedon

Knox silt loam, 14 to 20 percent slopes, in a timbered pasture in the uplands; in Crawford County, Iowa; 180 feet east and 150 feet north of the southwest corner of sec. 10, T. 82 N., R. 41 W.; USGS Dunlap NE topographic quadrangle; lat. 41 degrees 55 minutes 18.5 seconds N. and long. 95 degrees 36 minutes 49 seconds W., NAD 83:

A—0 to 7 inches; very dark brown (10YR 3/2) silt loam, brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure parting to moderate fine granular; friable; many fine and medium roots; many very fine and fine tubular pores; many distinct black (10YR 2/1) organic coats on faces of peds; slightly acid; clear smooth boundary.

E—7 to 13 inches; dark grayish brown (10YR 4/3) silt loam, grayish brown (10YR 5/3) dry; moderate very thin and thin platy structure; friable; many very fine and fine roots; many very fine and fine tubular pores; few distinct light brownish gray (10YR 6/2) silt coats on faces of plates; slightly acid; clear smooth boundary.

Bt1—13 to 19 inches; brown (10YR 4/3) silty clay loam; moderate and strong very fine and fine subangular blocky structure; friable; many very fine and fine roots; many very fine and fine tubular pores; common distinct dark brown (10YR 3/3) organic coats on faces of peds; very few distinct light brownish gray (10YR 6/2) (dry) silt coats on faces of peds; moderately acid; clear smooth boundary.

Bt2—19 to 29 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium prismatic structure parting to moderate and strong fine subangular blocky; friable; common very fine and fine roots; many very fine and fine tubular pores; common distinct brown (10YR 4/3) clay films on faces of peds; few distinct light brownish gray (10YR 6/2) (dry) silt coats on faces of peds; few distinct dark brown (10YR 3/3) organic coats on faces of peds; moderately acid; clear smooth boundary.

Bt3—29 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium and coarse prismatic structure parting to moderate fine subangular blocky; friable; common very fine and fine roots; many very fine and fine tubular pores; common distinct brown (10YR 4/3) clay films on faces of peds and on surfaces along pores; few distinct light brownish gray (10YR 6/2) (dry) silt coats on faces of peds; moderately acid; gradual smooth boundary.

Bt4—40 to 60 inches; yellowish brown (10YR 5/4) silt loam; moderate medium and coarse prismatic structure parting to moderate fine subangular blocky; friable; common very fine and fine roots; many very fine and fine tubular pores; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) (dry) silt coats on faces of peds; moderately acid; gradual smooth boundary.

Bt5—60 to 70 inches; yellowish brown (10YR 5/4) silt loam; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine roots; many very fine and fine tubular pores; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) (dry) silt coats on faces of peds; slightly acid; clear smooth boundary.

BC—70 to 80 inches; yellowish brown (10YR 5/4) silt loam; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; friable; common very fine roots; many very fine and fine tubular pores; common distinct light brownish gray (10YR 6/2) (dry) silt coats on faces of peds; slightly acid.

Range in Characteristics

A or Ap horizon:

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

E horizon:

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

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

BC horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam
Reaction—moderately acid to neutral

Liston Series

Typical Pedon

Liston clay loam (fig. 13), in an area of Liston-Burchard complex, 14 to 18 percent slopes, moderately eroded, in a cultivated field in the uplands; in Crawford County, Iowa; about 9.5 miles northeast of Denison; 840 feet north and 1,410 feet west of the southeast corner of sec. 28, T. 85 N., R. 38 W.; USGS Kiron topographic quadrangle; lat. 42 degrees 08 minutes 29.4 seconds N. and long. 95 degrees 16 minutes 08.9 seconds W., NAD 83:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many very fine and fine roots; many very fine and fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—5 to 12 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; firm; many very fine roots; many very fine and fine tubular pores; common distinct dark brown (10YR 3/3) organic coats on vertical faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk1—12 to 18 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; firm; many very fine roots; common very fine and fine tubular pores; common fine and medium very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—18 to 29 inches; yellowish brown (10YR 5/4) clay loam; moderate medium and coarse prismatic structure parting to moderate fine subangular blocky; firm; common very fine roots; common very fine and fine tubular pores; common medium coarse very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk3—29 to 38 inches; yellowish brown (10YR 5/4) clay loam; moderate medium and coarse prismatic structure parting to moderate fine angular blocky; firm; common very fine roots; common very fine and fine tubular pores; common medium and coarse very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; few fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.

Figure 13.—Profile of Liston clay loam.

C1—38 to 55 inches; brown (10YR 5/3) clay loam; massive; firm; common very fine roots; common very fine and fine tubular pores; common fine and medium very pale brown (10YR 8/2) masses of carbonate; common fine and medium very pale brown (10YR 8/2) carbonate concretions; common fine and medium prominent strong brown (7.5YR 4/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—55 to 67 inches; about 50 percent strong brown (7.5YR 5/6) and 50 percent grayish brown (2.5Y 5/2) clay loam; massive; firm; common very fine and fine tubular pores; common fine and medium very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few distinct very dark brown (7.5YR 2/2) manganese stains on faces of peds and in pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C3—67 to 80 inches; about 50 percent strong brown (7.5YR 5/6) and 50 percent gray (2.5Y 6/1) clay loam; massive; firm; common very fine and fine tubular pores;

common fine and medium very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few distinct very dark brown (7.5YR 2/2) manganese stains on faces of peds and in pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches

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

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

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

C horizon:
Hue—7.5YR, 10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 6
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

Marshall Series

Typical Pedon

Marshall silty clay loam (fig. 14), 2 to 5 percent slopes, in a cultivated field on a ridgetop; in Crawford County, Iowa; 2,000 feet south and 310 feet west of the northeast corner of sec. 12, T. 83 N., R. 37 W.; USGS Arcadia topographic quadrangle; lat. 42 degrees 01 minute 03 seconds N. and long. 95 degrees 05 minutes 36 seconds W., NAD 27:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure parting to weak fine granular; friable; many very fine to medium roots; many very fine tubular pores; moderately acid; abrupt smooth boundary.

A1—7 to 14 inches; very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; many very fine to medium roots; many very fine tubular pores; common distinct very dark brown (10YR 2/2) organic coats on vertical faces of peds and in pores; moderately acid; clear smooth boundary.

Figure 14.—Profile of Marshall silty clay loam.

A2—14 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; many very fine to medium roots; many very fine and fine tubular pores; many distinct very dark brown (10YR 2/2) organic coats on faces of peds and in pores; slightly acid; clear smooth boundary.

Bw1—22 to 36 inches; brown (10YR 4/3) silty clay loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine and fine roots; many very fine and fine tubular pores; few distinct dark brown (10YR 3/3) organic coats on faces of peds and in pores; slightly acid; clear smooth boundary.

Bw2—36 to 41 inches; brown (10YR 5/3) silty clay loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine and fine roots; many very fine and fine tubular pores; few fine and medium faint grayish brown (10YR 5/2) redoximorphic depletions; common fine and medium distinct yellowish brown (10YR 5/6) and few fine faint brown (7.5YR 4/4) redoximorphic concentrations; slightly acid; clear smooth boundary.

Bw3—41 to 53 inches; brown (10YR 5/3) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; common very fine and fine roots; many very fine and fine tubular pores; few distinct dark grayish brown (10YR 4/2) organic coats in root channels and pores; few fine irregular very dark brown (10YR 2/2) masses of manganese; common fine and medium faint grayish brown (10YR 5/2) redoximorphic depletions; common fine and medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid; gradual smooth boundary.

BC—53 to 62 inches; brown (10YR 5/3) silty clay loam; weak coarse prismatic structure; friable; few very fine roots; many very fine and fine tubular pores; common fine and medium faint grayish brown (10YR 5/2) redoximorphic depletions; common fine and medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual smooth boundary.

C1—62 to 68 inches; mottled brown (10YR 5/3), grayish brown (2.5Y 5/2), and dark yellowish brown (10YR 4/6) silty clay loam; massive; friable; few very fine roots; many very fine and fine tubular pores; neutral; gradual smooth boundary.

C2—68 to 74 inches; brown (10YR 5/3) silty clay loam; massive; friable; few very fine roots; many very fine and fine tubular pores; few fine irregular very dark brown (10YR 2/2) masses of manganese; many fine and medium faint grayish brown (2.5Y 5/2) redoximorphic depletions; many fine and medium distinct dark yellowish brown (10YR 4/6) and common fine and medium distinct reddish brown (5YR 4/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Cg—74 to 80 inches; grayish brown (2.5Y 5/2) silty clay loam; massive; friable; many very fine and fine tubular pores; many fine and medium prominent dark yellowish brown (10YR 4/6) and common fine and medium faint brown (10YR 5/3) redoximorphic concentrations; neutral.

Range in Characteristics

Depth to carbonates: More than 72 inches

Thickness of the mollic epipedon: 10 to 24 inches

Note: Grayish brown, yellowish brown, strong brown, and brown redoximorphic features are in the lower part of the B horizon and in the C horizon. These features are considered relict.

Ap and A horizons:

Hue—10YR
Value—2 or 3
Chroma—1 or 2; 2 in pedons where value is 3
Texture—silty clay loam or silt loam
Reaction—moderately acid to neutral

Bw horizon:

Hue—10YR
Value—3 or 4 (upper part); 4 or 5 (lower part)
Chroma—3 (upper part); 3 or 4 (lower part)
Texture—silty clay loam
Reaction—moderately acid or slightly acid

BC and C horizons:

Hue—10YR to 5Y
Value—4 or 5
Chroma—2 to 6
Texture—silty clay loam or silt loam
Reaction—slightly acid or neutral

Taxadjunct features: The moderately eroded and severely eroded Marshall soils in Crawford County are taxadjuncts because the surface layer does not meet the thickness requirements for a Mollisol.

Minden Series

Typical Pedon

Minden silty clay loam, 0 to 2 percent slopes, in a cultivated field on a slightly convex slope; in Cass County, Iowa; 380 feet north and 1,560 feet west of the southeast corner of sec. 31, T. 75 N., R. 37 W.; USGS Griswold topographic quadrangle; lat. 41 degrees 14 minutes 45.9 seconds N. and long. 95 degrees 08 minutes 32.2 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; many very fine roots throughout; many very fine tubular pores; moderately acid; clear smooth boundary.

A1—7 to 15 inches; black (10YR 2/1) silty clay loam, gray (10YR 4/1) dry; weak fine granular structure; friable; many very fine roots throughout; many very fine tubular pores; moderately acid; gradual smooth boundary.

A2—15 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak medium granular; friable; common very fine roots throughout; common very fine tubular pores; moderately acid; gradual smooth boundary.

Bw1—22 to 32 inches; dark grayish brown (10YR 4/2) silty clay loam; weak fine subangular blocky structure; friable; common very fine roots throughout; common very fine tubular pores; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

Bw2—32 to 40 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine and medium subangular blocky structure; friable; few very fine roots throughout; common very fine tubular pores; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

Bw3—40 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam; weak fine prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots throughout; common very fine tubular pores; many coarse distinct yellowish brown (10YR 5/4) and many coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

Bw4—48 to 58 inches; grayish brown (2.5Y 5/2) silty clay loam; moderate medium subangular blocky structure; friable; common coarse distinct yellowish brown (10YR 5/4) and many coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

BC—58 to 66 inches; grayish brown (2.5Y 5/2) silty clay loam; weak coarse subangular blocky structure; friable; common coarse distinct yellowish brown (10YR 5/4) and common coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

C—66 to 80 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; common coarse distinct yellowish brown (10YR 5/4) and common coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 24 inches
Depth to carbonates: More than 72 inches

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

Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2
Texture—silty clay loam
Reaction—moderately acid to neutral

BC horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 to 6
Texture—silty clay loam
Reaction—moderately acid to neutral

C horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 to 6
Texture—silt loam
Reaction—moderately acid to neutral

Monona Series

Typical Pedon

Monona silt loam, 2 to 5 percent slopes, in a cultivated field on a ridgetop; in Crawford County, Iowa; 480 feet east and 180 feet north of the southwest corner of sec. 35, T. 84 N., R. 41 W.; USGS Charter Oak topographic quadrangle; lat. 42 degrees 02 minutes 15.6 seconds N. and long. 95 degrees 35 minutes 35 seconds W., NAD 83:

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

A—8 to 16 inches; very dark brown (10YR 2/2) silt loam; some mixing of dark brown (10YR 3/3) in the lower part; dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; few very fine roots; many very fine and fine tubular pores; few distinct very dark grayish brown (10YR 3/2) organic coats on faces of peds; moderately acid; clear smooth boundary.

Bw1—16 to 23 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; few very fine roots; many very fine and fine tubular pores; slightly acid; clear smooth boundary.

Bw2—23 to 30 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; few very fine roots; many very fine and fine tubular pores; few distinct very dark grayish brown (10YR 3/2) organic coats on vertical faces of peds; slightly acid; gradual smooth boundary.

Bw3—30 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few very fine roots; many very fine and fine tubular pores; neutral; gradual smooth boundary.

Bw4—45 to 52 inches; yellowish brown (10YR 5/4) silt loam; weak coarse prismatic structure parting to weak medium subangular blocky; friable; few very fine roots; common very fine and fine tubular pores; few fine prominent irregular dark reddish brown (5YR 2/2) masses of manganese; neutral; gradual smooth boundary.

C—52 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few very fine roots; common very fine and fine tubular pores; few fine prominent irregular dark reddish brown (5YR 2/2) masses of manganese; few fine and medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; common fine and medium distinct dark yellowish brown (10YR 4/6) and few fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; neutral.

Range in Characteristics

Depth to relict redoximorphic features: 22 to 65 inches
Thickness of the mollic epipedon: 10 to 24 inches
Note: The redoximorphic features described in the lower part of the Bw horizon and in the C horizon are considered relict.

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

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

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam or silty clay loam
Reaction—slightly acid or neutral

C horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam
Reaction—neutral to moderately alkaline

Taxadjunct features: The moderately eroded and severely eroded Monona soils in Crawford County are taxadjuncts because the surface layer does not meet the thickness requirements for a Mollisol.

Napier Series

Typical Pedon

Napier silt loam, 2 to 5 percent slopes, in a cultivated field in an upland drainageway; in Crawford County, Iowa; 280 feet south and 850 feet east of the northwest corner of sec. 30, T. 85 N., R. 41 W.; USGS Danbury topographic quadrangle; lat. 42 degrees 03 minutes 56.9 seconds N. and long. 95 degrees 40 minutes 05.1 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt 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; few fine tubular pores; many distinct black (10YR 2/1) organic coats on faces of peds; slightly acid; abrupt smooth boundary.

A1—9 to 17 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; common fine tubular pores; slightly acid; gradual smooth boundary.

A2—17 to 26 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common very fine roots; common fine tubular pores; slightly acid; gradual smooth boundary.

BA—26 to 36 inches; very dark grayish brown (10YR 3/3) silt loam, dark grayish brown (10YR 4/3) dry; weak fine subangular blocky structure; friable; few very fine roots; common fine tubular pores; many distinct dark brown (10YR 3/2) organic coats on faces of peds and on surfaces along pores; slightly acid; gradual smooth boundary.

Bw1—36 to 47 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; few very fine roots; common fine tubular pores; common distinct very dark grayish brown (10YR 3/2) organic coats on faces of peds and on surfaces along pores; slightly acid; gradual smooth boundary.

Bw2—47 to 61 inches; brown (10YR 4/3) silt loam; weak fine prismatic structure parting to moderate fine subangular blocky; friable; common fine tubular pores; very few distinct light brownish gray (10YR 6/2) silt coats on faces of peds; slightly acid; gradual smooth boundary.

Bw3—61 to 71 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; common fine tubular pores; slightly acid; clear smooth boundary.

C—71 to 80 inches; brown (10YR 4/3) silt loam; massive; friable; neutral.

Range in Characteristics

Depth to carbonates: More than 36 inches
Thickness of the mollic epipedon: 24 to 40 inches

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

BA horizon:
Hue—10YR
Value—3
Chroma—3
Texture—silt loam
Reaction—slightly acid to moderately alkaline

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

C horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam
Reaction—slightly acid to moderately alkaline

Nodaway Series

Typical Pedon

Nodaway silt loam (fig. 15), 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; in Fremont County, Iowa; about 3 miles east of Sidney; about 2,530 feet north and 265 feet west of the southeast corner of sec. 30, T. 69 N., R. 41 W.; USGS Randolph quadrangle; lat. 40 degrees 51 minutes 11 seconds N. and long. 95 degrees 40 minutes 15 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many roots; neutral; clear smooth boundary.

C1—7 to 31 inches; stratified, dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and very dark grayish brown (10YR 3/2) silt loam; massive with weak thin alluvial stratification; friable; neutral; clear wavy boundary.

C2—31 to 42 inches; stratified, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silty clay loam; massive with weak thin alluvial stratification; friable; few very thin strata of silt loam; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual wavy boundary.

C3—42 to 80 inches; stratified, dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and very dark grayish brown (10YR 3/2) silt loam; massive with weak thin alluvial stratification; friable; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; neutral.

Range in Characteristics

Depth to buried horizons: More than 40 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 or neutral

C horizon:
Hue—10YR
Value—2 to 5
Chroma—1 or 2
Texture—silt loam or silty clay loam or stratified with these textures
Reaction—slightly acid or neutral

Ab horizon (if it occurs):
Hue—10YR or N
Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam or silt loam
Reaction—slightly acid or neutral

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

Figure 15.—Profile of Nodaway silt loam.

Rawles Series

Typical Pedon

Rawles silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; in Crawford County, Iowa; 400 feet south and 1,460 feet east of the northwest corner of sec. 31, T. 83 N., R. 41 W.; USGS Dunlap NW topographic quadrangle; lat. 41 degrees 57 minutes 49.5 seconds N. and long. 95 degrees 39 minutes 58.8 seconds W., NAD 83:

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; common very fine tubular pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—8 to 25 inches; stratified, dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam; massive but parting along horizontal layers of deposition; friable; few very fine and fine roots; common very fine and fine tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—25 to 33 inches; very dark grayish brown (10YR 3/2) silt loam; massive but parting along horizontal layers of deposition; friable; few very fine and fine roots; common very fine and fine tubular pores; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; slightly effervescent; slightly alkaline; abrupt wavy boundary.

Ab1—33 to 52 inches; very dark brown (10YR 2/2) silty clay loam; weak fine subangular blocky structure; friable; many very fine and fine tubular pores; many distinct black (10YR 2/1) organic coats on faces of peds; slightly effervescent; slightly alkaline; gradual smooth boundary.

Ab2—52 to 64 inches; very dark brown (10YR 2/2) silty clay loam; moderate fine subangular blocky structure; friable; many very fine and fine tubular pores; many distinct black (10YR 2/1) organic coats on faces of peds; slightly effervescent; slightly alkaline; gradual smooth boundary.

Ab3—64 to 74 inches; very dark brown (10YR 2/2) silty clay loam; moderate fine subangular blocky structure; friable; many very fine and fine tubular pores; many distinct black (10YR 2/1) organic coats on faces of peds; common fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; very slightly effervescent; slightly alkaline; clear smooth boundary.

Ab4—74 to 80 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine subangular blocky structure; friable; many very fine and fine tubular pores; many distinct black (10YR 2/1) organic coats on faces of peds; common fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; very slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to buried soil: 20 to 40 inches
Depth to carbonates: 0 to 10 inches

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

C horizon:
Hue—10YR
Value—3 to 5
Chroma—2 or 3
Texture—silt loam
Reaction—slightly alkaline or moderately alkaline

Ab horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—slightly acid to slightly alkaline

Shelby Series

Typical Pedon

Shelby clay loam, 9 to 14 percent slopes, in a cultivated field; in Adair County, Iowa; about 6 miles north of Greenfield; about 1,617 feet east and 2,109 feet south of the northwest corner of sec. 18, T. 76 N., R. 31 W.; USGS Rosserdale topographic quadrangle; lat. 41 degrees 22 minutes 57 seconds N. and long. 94 degrees 27 minutes 58 seconds W., NAD 83:

Ap—0 to 7 inches; very dark brown (10YR 2/2) and black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; moderately acid; clear smooth boundary.

AB—7 to 11 inches; very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), and dark brown (10YR 3/3) clay loam, very dark brown (10YR 2/2) dry; moderate fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

Bt1—11 to 17 inches; dark brown (10YR 3/3) clay loam; moderate fine subangular blocky structure; firm; many distinct continuous clay films on faces of peds; about 3 percent gravel; strongly acid; clear smooth boundary.

Bt2—17 to 23 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine subangular blocky structure; firm; many distinct clay films on faces of peds; moderately acid; clear smooth boundary.

Bt3—23 to 34 inches; brown (10YR 4/3) clay loam; weak fine and medium subangular blocky structure; firm; many distinct continuous clay films on faces of peds; few fine faint grayish brown (2.5Y 5/2) redoximorphic depletions; few coarse prominent strong brown (7.5YR 5/6) and reddish yellow (7.5YR 6/8) redoximorphic concentrations; about 3 percent gravel; moderately acid; gradual smooth boundary.

Bt4—34 to 48 inches; brown (10YR 4/3) clay loam; weak medium and coarse subangular blocky structure; firm; common distinct clay films on faces of peds; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; about 3 percent gravel; slightly acid; clear smooth boundary.

Btk—48 to 60 inches; mottled grayish brown (2.5Y 5/2) and dark yellowish brown (10YR 4/4) clay loam; weak coarse prismatic structure; firm; common distinct clay films on vertical faces of peds; common white soft to very hard carbonate nodules less than 1/4 inch in diameter; about 3 percent gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—60 to 72 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) clay loam; massive; friable; about 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics:

Thickness of the mollic epipedon: 10 to 20 inches
Depth to carbonates: More than 30 inches
Note: The redoximorphic features described in this pedon are believed to be relict and were not considered as indicators of current wetness conditions. These features were not considered in the classification of these soils.

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

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

Bk or Btk horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—clay loam or loam
Reaction—slightly alkaline or moderately alkaline

BC or C horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—clay loam, loam, or sandy clay loam
Reaction—neutral to moderately alkaline

Smithland Series

Typical Pedon

Smithland silty clay loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; in Crawford County, Iowa; about 1,680 feet west and 1 foot south of the northeast corner of sec. 34, T. 82 N., R. 41 W.; USGS Dunlap NE topographic quadrangle; lat. 41 degrees 51 minutes 59.6 seconds N. and long. 95 degrees 36 minutes 19.4 seconds W., NAD 83:

Ap—0 to 5 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak very fine and fine subangular blocky structure; friable; many fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

A1—5 to 11 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; friable; many fine roots; many very fine tubular pores; neutral; gradual smooth boundary.

A2—11 to 30 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; many very fine tubular pores; neutral; gradual smooth boundary.

A3—30 to 39 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few very fine roots; common very fine tubular pores; neutral; gradual smooth boundary.

Bg1—39 to 46 inches; very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak very fine prismatic structure parting to weak fine subangular blocky; friable; few very fine roots; common very fine tubular pores; common distinct black (10YR 2/1) organic coats on faces of peds; common fine faint very dark grayish brown (2.5Y 3/2) redoximorphic concentrations; neutral; gradual smooth boundary.

Bg2—46 to 56 inches; very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine tubular pores; common fine faint dark grayish brown (2.5Y 4/2) redoximorphic depletions; neutral; gradual smooth boundary.

Bg3—56 to 66 inches; very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine tubular pores; many fine faint dark grayish brown (2.5Y 4/2) redoximorphic depletions; neutral; gradual smooth boundary.

BCg—66 to 80 inches; very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak medium prismatic structure; friable; few very fine tubular pores; many fine faint dark grayish brown (2.5Y 4/2) redoximorphic depletions; slightly acid.

Range in Characteristics

Depth to carbonates: 60 inches or more
Thickness of the mollic epipedon: 36 inches or more
Other features: Some pedons have silt loam overwash as much as 10 inches thick.

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

Bg horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—silty clay loam
Reaction—moderately acid to neutral

BCg horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 or 2
Texture—silty clay loam
Reaction—moderately acid to neutral

Cg horizon (if it occurs):
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 or 2
Texture—silty clay loam
Reaction—slightly acid or neutral

Strahan Series

Typical Pedon

Strahan silt loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field on a convex slope; in Mills County, Iowa; about 7 miles southeast of Malvern; 522 feet east and 1,528 feet south of the northwest corner of sec. 18, T. 71 N., R. 42 W.

Ap—0 to 7 inches; mixed brown (10YR 4/3) and very dark grayish brown (10YR 3/2) silt loam, pale brown (10YR 6/3) and dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

C1—7 to 18 inches; mottled brown (10YR 4/3), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6) silt loam; massive; very friable; neutral; gradual smooth boundary.

C2—18 to 39 inches; grayish brown (10YR 5/2) silt loam; common medium and coarse faint yellowish brown (10YR 5/6 to 5/8) mottles; massive; very friable; neutral; gradual smooth boundary.

C3—39 to 60 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) silt loam; massive; very friable; few nodules high in iron (pipestems), few dark stains, and few soft calcium carbonate accumulations; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 60 inches; typically decreasing with increasing gradient on convex slopes

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

C horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—2 to 8
Texute—silt loam
Reaction—neutral or slightly alkaline in the upper part; slightly alkaline or moderately alkaline in the lower part

Zook Series

Typical Pedon

Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; in Crawford County, Iowa; 820 feet north and 1,450 feet east of the southwest corner of sec. 12, T. 84 N., R. 41 W.; USGS Charter Oak topographic quadrangle; lat. 42 degrees 05 minutes 51.3 seconds N. and long. 95 degrees 34 minutes 06.9 seconds W., NAD 83:

Ap—0 to 6 inches; black (10YR 2/1) silty clay 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; common very fine tubular pores; moderately acid; abrupt smooth boundary.

A1—6 to 14 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; common very fine and fine roots; many very fine and fine tubular pores; slightly acid; clear smooth boundary.

A2—14 to 21 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; common very fine roots; many very fine and fine tubular pores; neutral; clear smooth boundary.

A3—21 to 36 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; common very fine roots; many very fine and fine tubular pores; neutral; clear smooth boundary.

BA—36 to 48 inches; very dark gray (10YR 3/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium prismatic structure parting to moderate fine subangular blocky; friable; many distinct black (10YR 2/1) organic coatings on faces of peds; common very fine roots; many very fine and fine tubular pores; common fine prominent brown (7.5YR 4/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Bg1—48 to 56 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; many very fine and fine tubular pores; common fine prominent brown (7.5YR 4/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Bg2—56 to 64 inches; very dark gray (2.5Y 3/1) silty clay loam; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine roots; many very fine and fine tubular pores; common fine prominent brown (7.5YR 4/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Bg3—64 to 73 inches; very dark gray (2.5Y 3/1) silty clay loam; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; many very fine and fine tubular pores; common fine prominent brown (7.5YR 4/4) redoximorphic concentrations; neutral; clear smooth boundary.

Bg4—73 to 80 inches; dark gray (5Y 4/1) silty clay loam; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; many very fine and fine tubular pores; common fine prominent brown (7.5YR 4/4) redoximorphic concentrations; neutral.

Range in Characteristics

Thickness of the mollic epipedon: More than 36 inches
Depth to redoximorphic concentrations: 24 to 60 inches
Depth to carbonates: 60 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—moderately acid to slightly alkaline

Bg horizon or Cg horizon (if it occurs):
Hue—10YR, 2.5Y, or 5Y
Value—2 to 5
Chroma—1
Texture—silty clay loam or silty clay
Reaction—slightly acid or neutral

Formation of the Soils

This section relates the soils in the survey area to the major factors of soil formation.

Factors of Soil Formation

Soils form 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, chiefly plants, are the active factors of soil formation. They act on parent material that has accumulated through weathering of rocks and slowly change it into a natural body that has genetically related horizons. Relief conditions the effects of climate and plant and animal life. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of parent material into a soil. The length of time can vary, but some time is required for 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.

Parent Material

The accumulation of parent material is the first step in the formation of soil. Most soils formed in material that was transported from the site of the parent material and redeposited at a new location through the action of glacial ice, water, wind, or gravity. The principal kinds of parent material in Crawford County are glacial drift, loess, alluvium, and eolian sands.

Glacial drift is rock material transported and deposited by glacial ice, including the material sorted and unsorted by meltwater. It includes glacial till, glacial sediments, and glacial outwash. Till consists of unsorted deposits in which particles range in size from boulders to clay. The glacial material exposed in Crawford County is made up predominantly of till. The survey area underwent at least two major episodes of glaciation. They are often referred to as Pleistocene glacial stages, previously called the Nebraskan and Kansan but now referred to collectively as the Pre-Illinoian. These deposits are considered to be more than 300,000 years in age. The Pre-Illinoian till in Crawford County is mostly buried by loess, or wind-deposited material, but in some of the steeper eroded areas, especially along major rivers and streams, the till has been exposed on the shoulders and on the lower part of the slopes. Burchard and Liston soils formed in Pre-Illinoian glacial till.

Loess is silty material deposited by the wind. It consists mainly of silt- and clay-sized particles and small amounts (generally less than 15 percent) of fine or very fine sand. The loess in Crawford County typically ranges from 5 to 30 feet in thickness, but in some areas it is as much as 80 feet thick. The loess typically overlies Pre-Illinoian glacial drift and is commonly referred to as Wisconsin-age loess, ranging in age from about 12,500 to 31,000 years (Prior, 1991). Loess also typically caps the high stream terraces, which are commonly underlain by water-deposited sand and/or gravel. The loess was transported to the area following extensive erosion of the glacial surface, which filled river valleys with massive amounts of sediment. Although some of the loess is from local sources near to the area, most of the material originated in the Missouri River and Big Sioux River valleys. The loess was deposited by the prevailing northwest-to-southeast winds, which created a similar landscape pattern across western and southwestern Iowa.

Alluvium is sediment deposited by water on the flood plains along rivers and streams, on stream terraces, and in upland drainageways. The texture of alluvium varies widely because of differences in the material from which it was derived and the manner in which it was deposited. Alluvium that is adjacent to the present stream channel is typically silty and commonly contains thin strata of coarser sandy material from recent flooding. Nodaway soils formed in such stratified silty deposits. The content of clay in alluvium typically increases as the distance from the stream channel increases, particularly in the larger watershed areas. Kennebec silt loam and Kennebec silty clay loam formed away from the present stream channel, and Colo, Smithland, and Zook silty clay loams, which are much higher in clay content than the Nodaway or Kennebec soils, formed closest to the base of the upland slopes or high stream terraces. Alluvium that has been transported only a short distance is referred to as local alluvium because it 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 footslopes of much steeper slopes, is often referred to as colluvium. Judson and Napier soils formed in local alluvium and/or colluvium and are commonly downslope from the silty loess soils.

Eolian soils formed in sandy textured material deposited by the wind. The source of the sands is local in origin, primarily the result of the erosion of the glacial drift, and the deposits are in the uplands or along high stream terraces, commonly along the east side of the major rivers and streams. Chute soils formed in eolian sands.

Figure 16 provides a cross sectional view of the relationship between soils and parent material in the eastern part of Crawford County. Figure 17 provides a cross sectional view of this relationship in the western part of the county.

Climate

The soils of Crawford County formed under a variety of climatic conditions. They began to form following the deposition of loess about 12,500 years ago, when the climate began to warm and become less humid. Although this part of Iowa was not glaciated during the Cary Glacial Period, the return to much colder conditions to the north and east certainly had an effect on the type of vegetative growth and in slowing down the formation processes. During the post-Cary glaciation period 13,800 to 10,500 years ago, the climate was cool and the vegetation was dominantly conifers (Walker, 1966). 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 became dominant. A change from a dry to a moister climate began about 3,000 years ago (McComb and Loomis, 1944). The present climate is referred to as subhumid and midcontinental.

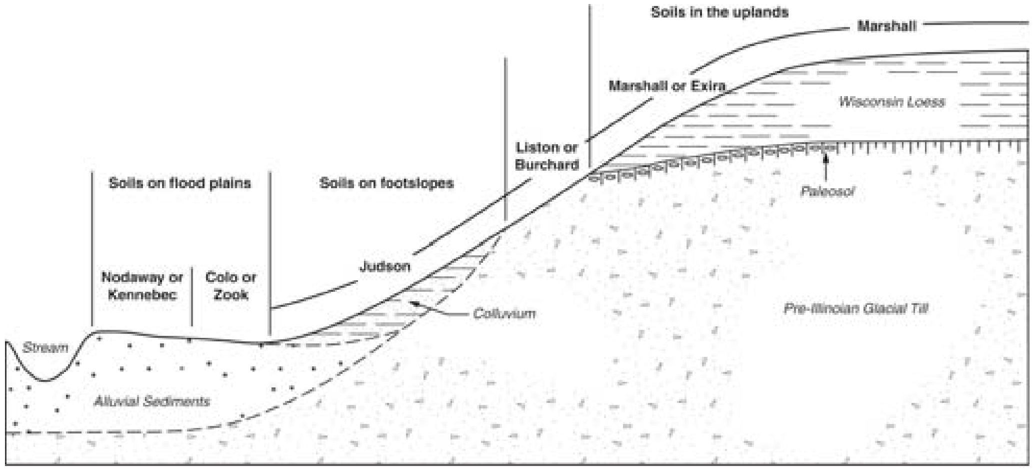

Figure 16.—A cross section showing the relationship between soils and parent material in the eastern part of Crawford County.

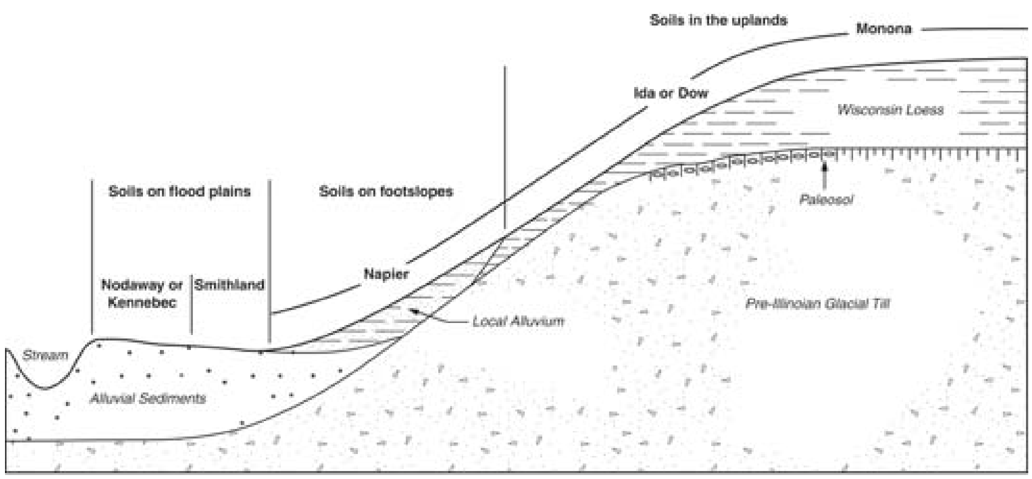

Figure 17.—A cross section showing the relationship between soils and parent material in the western part of Crawford County.

A nearly uniform climate 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 soils in low areas, such as bottom lands, have been forming is typically wetter and colder than in most of the surrounding areas.

Changes in temperature activate the weathering of parent material by water and air. As the parent material weathers, changes caused by physical and chemical actions take place. Rainfall affects the amount of leaching in the soil and the kinds of plants that grow on the soil. Climate indirectly affects soil formation through the effects of temperature and other climatic factors on the plant and animal life on and in the soil. Crawford County is on the border of the more humid conditions of central and eastern Iowa and the less humid conditions of western Iowa and the bordering State of

Nebraska. The less humid conditions have had an influence on the soil properties of the calcareous soils of the Ida and Liston series. These soils have a high content of calcium carbonate because of the influence of the climatic effects on the weathering processes.

Living Organisms

All living organisms, including vegetation, animals, bacteria, and fungi, are important factors of soil formation. Plants are especially significant (McComb and others, 1961). Soil formation really begins with the growth of vegetation. Native grasses typically have an abundance of above-ground growth as well as a myriad of fibrous roots that penetrate the soil to an average depth of 10 to 20 inches. As these plants grow, and particularly when they die, they add large amounts of organic matter to the surface layer and contribute various nutrients to the surface layer and subsoil. Trees commonly feed on plant nutrients deep in the subsoil and contribute little organic material to the surface layer, other than that added by fallen leaves, twigs, and branches. Much of the organic material from dead trees actually remains on the soil surface.

Most of the soils of Crawford County formed under prairie grasses or under a mixture of prairie grasses and water-tolerant plants. A few soils formed under a mixture of hardwood trees and prairie grasses. Marshall and Monona soils are examples of soils that formed under prairie grasses. In their uneroded condition, these soils typically have a dark surface layer that is 10 to 20 inches thick and that contains 3 to 4 percent organic matter. Colo and Zook soils are examples of soils that formed under prairie grasses and water-tolerant plants. These soils have a thicker, darker topsoil and more organic matter than soils that formed strictly under a cover of prairie grasses. Knox and Liston soils are examples of soils that formed under a mixture of scattered hardwood trees and prairie grasses. These soils typically have a moderately dark surface layer that is 7 to 10 inches thick and that contains 1 to 3 percent organic matter.

The vegetation chiefly determines the color of the surface layer, the content of organic matter, and the nutrients in the soil, and the plant roots create soil pores and root channels. Earthworms and other burrowing animals also create soil pores and keep the soil porous. Bacteria and fungi help to decompose the vegetation and thereby release plant nutrients.

Important changes take place in the soil after it is artificially drained and cultivated for agriculture or altered for such activities as the construction of homes or commercial buildings. Some of these changes have little effect on the soil formation processes, but others have dramatic effects.

Changes by erosion generally are 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 and of the finer structure that is typical in the upper part of the soil profile can reduce vegetative cover and increase runoff. Severe erosion can also expose calcium carbonates, which can cause nutrient deficiencies in plants and reduce crop yields.

Artificial drainage of soils, particularly in areas on bottom land, can improve conditions for cultivated crop growth but has also lowered the water table, increased soil temperatures, and changed chemical reactions in these normally cooler, wetter soils.

Human activities, such as soil excavation, tree removal, and building construction, can also alter the natural soil formation processes through soil compaction and the subsequent decrease in percolation rates.

Management practices have increased the productivity of some soils and have reclaimed areas that otherwise were not suitable for crop production or building sites.

Crops can be grown, for example, in many areas where subsurface drainage has sufficiently lowered the water table. Applications of commercial fertilizers have helped to overcome the deficiencies in plant nutrients and organic matter and thus have increased the productivity of many soils, particularly in moderately and severely eroded areas. A knowledge of the soils and the history of human activity in specific areas helps to determine whether natural soil conditions occur in that area.

Relief

Relief indirectly influences soil formation through its effect on soil drainage, runoff, and erosion. More water runs off the steeper slopes, and less percolates into the soil. The higher the runoff rate, the less leaching of carbonates and the less movement of clay from the surface horizons into the subsoil. The susceptibility to erosion increases as slope increases. Much of Crawford County is moderately sloping to very steep, and many areas are thus moderately or severely eroded.

Slope aspect affects soil formation. For example, south-facing slopes generally are warmer and drier than north-facing slopes. As a result, they typically support a different kind of vegetation.

The strongly sloping to very steep Monona soils, the gently sloping to strongly sloping Ida soils, and the nearly level to very gently sloping Monona soils on terraces, all of which formed in the same kind of parent material and under similar types of vegetation, differ because of differences in topographic position (fig. 18). The thickness and color of the A horizon and the thickness of the solum in these soils are affected by slope. The A horizon and the solum are thicker in the less sloping soils, and the A horizon is darker.

The micro-relief of the nearly level Colo, Kennebec, Nodaway, and Zook soils on bottom land affects runoff, depth to the water table, and the rate at which new sediments are deposited by flooding. Colo and Zook soils are in low positions on the

Figure 18.—A typical landscape in the Monona-Napier-Ida association. Monona and Ida soils are in the gently sloping to steep areas in the background; Napier soils are in the foreground.

landscape, generally some distance from the stream channel. They are poorly drained and may be ponded for short periods. Kennebec and Nodaway soils are typically slightly higher on the landscape, are generally closer to the stream channel, and are better drained than the Colo and Zook soils.

Time

The passage of time enables relief, climate, and plant and animal life to bring about changes in the parent material. If these factors are active for long periods, very similar kinds of soil can form in widely different kinds of parent materials. Soil formation is generally interrupted, however, by geologic events that expose new parent materials. In Crawford County, new parent material has been added to the entire landscape several times in the geologic past (Simonson and others, 1952). The limestone and sandstone bedrock that underlies all of Iowa was covered by Pre-Illinoian glacial drift at least twice and then by loess. New parent material is added to the upland drainageways and to the bottom lands with every passing erosional or flooding event, which typically creates the youngest soils in the county.

Geologically, the soils of Crawford County are young. The radiocarbon technique for determining the age of carbonaceous material found in organic deposits as well as in till has made it possible to determine the approximate age of the soil materials in Iowa. The dating process has indicated that the soils that formed in loess in MLRA 107 are at least 12,500 years old. In much of Iowa, including Crawford County, erosion has beveled and in places removed the loess material from side slopes and redeposited it as new sediment downslope. The surfaces of soils on nearly level to very gently sloping upland divides, such as the Marshall soils, are thus older than the eroded side slopes of the Exira soils (less than 12,500 years old). Both are older than the alluvial or colluvial sediments in upland drainageways. Further dating and research indicate that the alluvium deposited at the base of steep side slopes and on the bottom land along major rivers and streams is less than 3,000 years old. Napier and Judson soils on footslopes and Colo, Zook, and Nodaway soils on bottom land represent some of the younger soils in Crawford County.

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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. 19). 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.

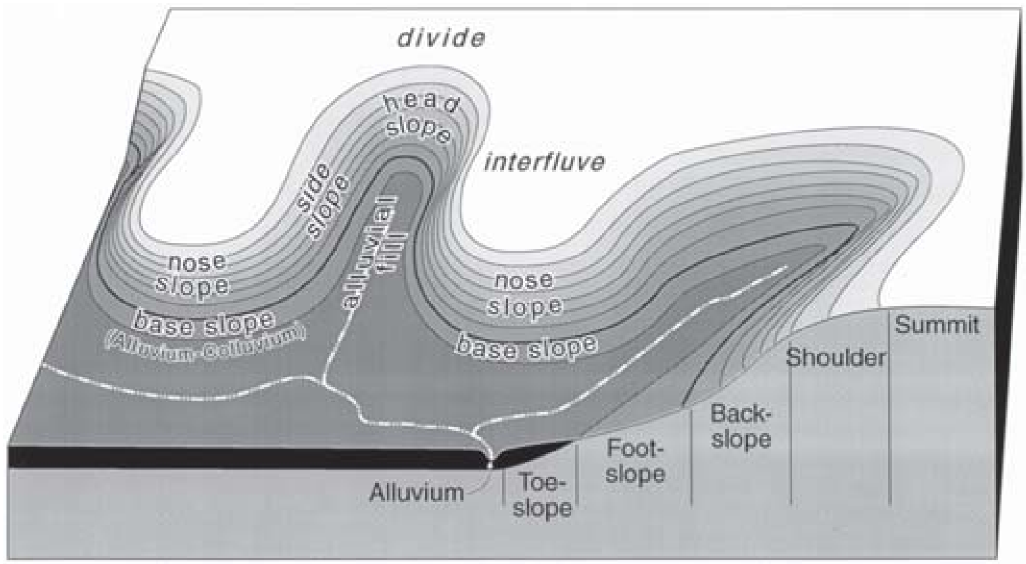

Figure 19.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

Base slope (geomorphology). A geomorphic component of hills (fig. 19) 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. 19); 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. 19). 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. 19). 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. 19).

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. 19); 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. 19). 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. 19). 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. 19). 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.

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. 19). 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. 19). 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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