United States Department of Agriculture

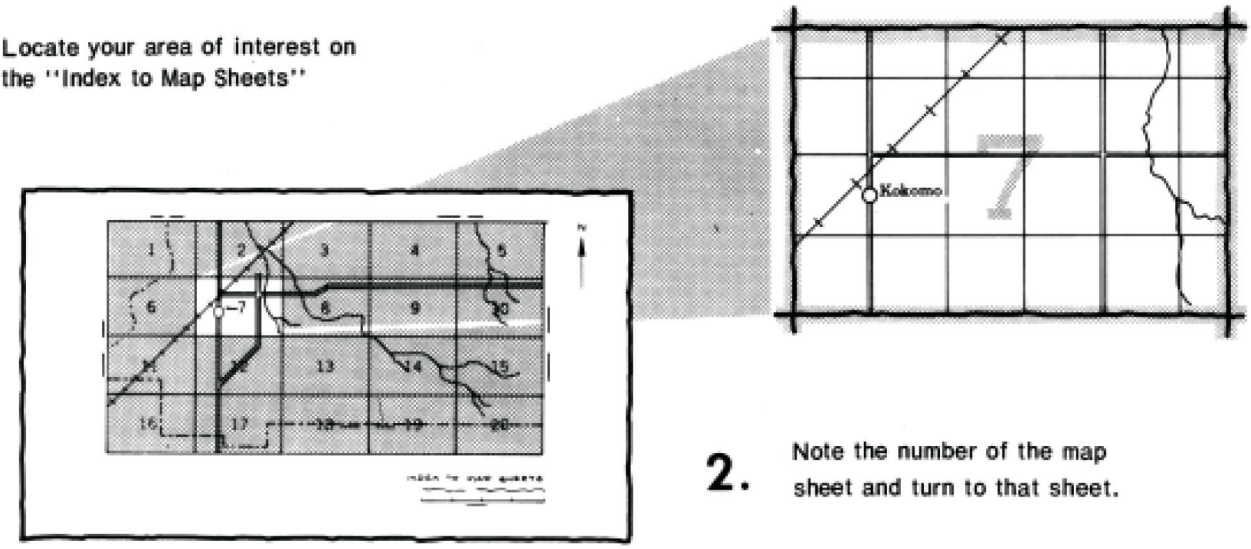
Soil Conservation Service

In cooperation with
Iowa Agriculture and Home Economics Experiment Station
Cooperative Extension Service
Iowa State University and
Department of Soil Conservation
State of Iowa

Soil Survey of Johnson County Iowa

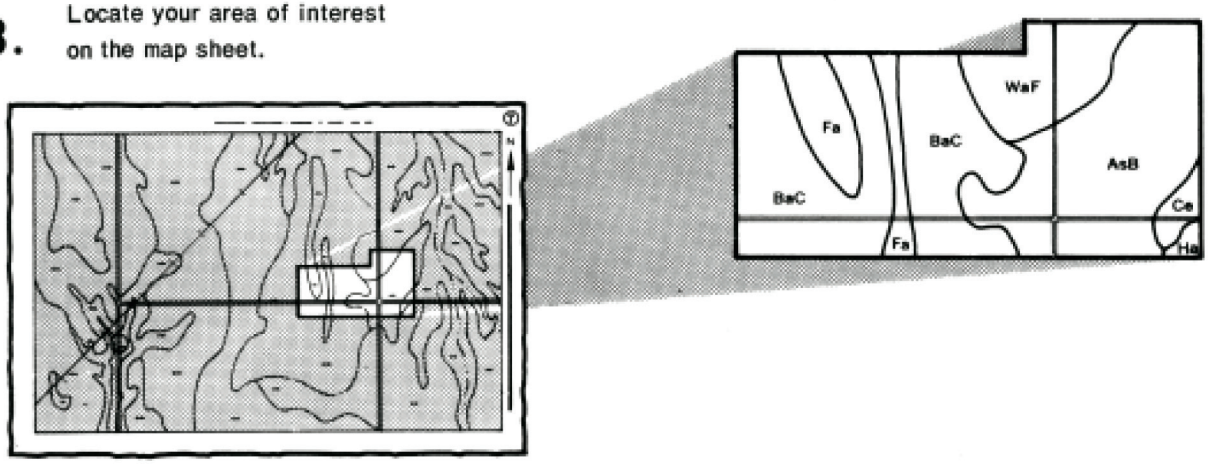
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

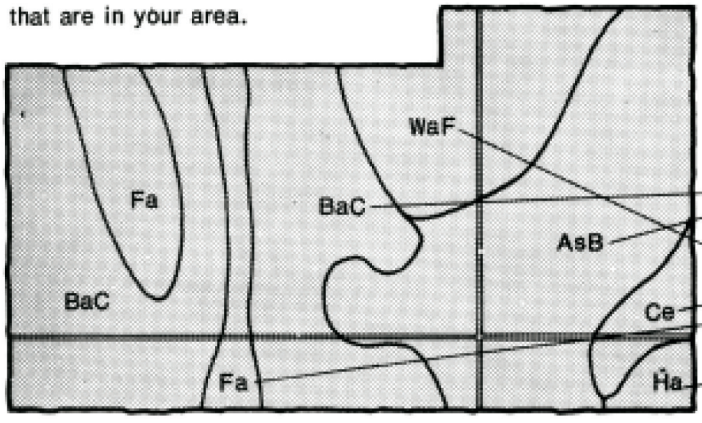


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



4. List the map unit symbols that are in your area.



Symbols

AsB
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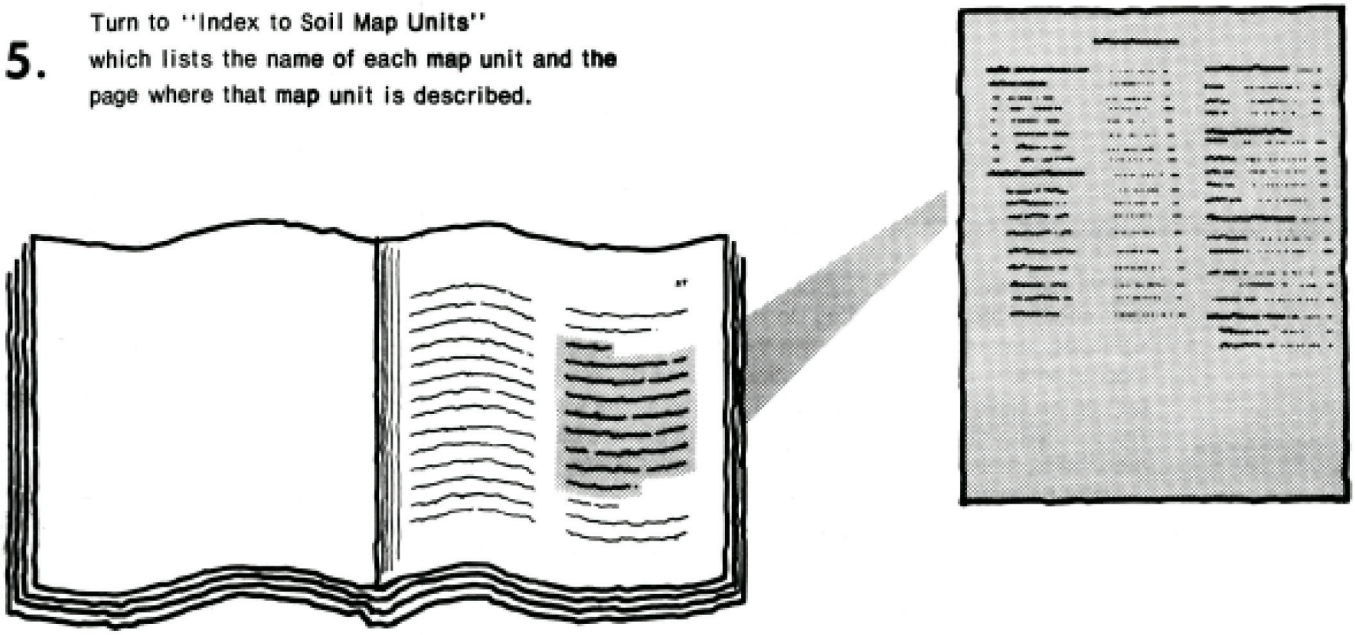
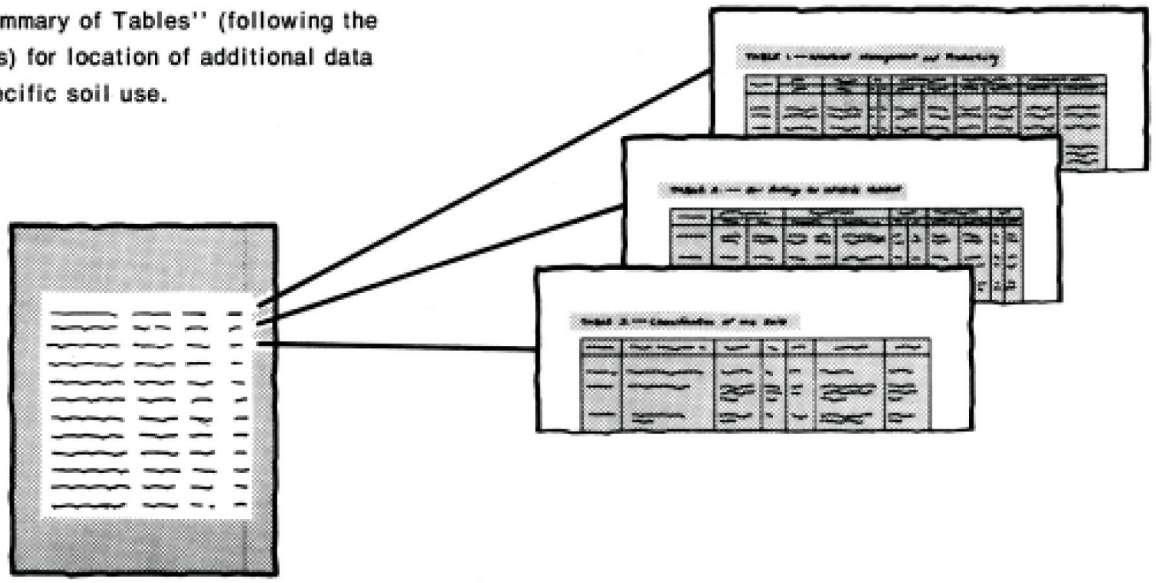
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

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 Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1974-78. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978.

This survey was made cooperatively by the Soil Conservation Service and the Iowa Agriculture and Home Economics Experiment Station, Cooperative Extension Service, Iowa State University, and the Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Johnson County Soil Conservation District. Funds appropriated by Johnson County were used to defray part of the cost of the survey.

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

Cover: An area of Kent Park. This excellent recreation area is in the Fayette-Downs association.

contents

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preface

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

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

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

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

soil survey of
Johnson County, Iowa

By Edward J. Schermerhorn

Fieldwork by H. H. Bright, W. N. Mulder, E. J. Schermerhorn, and N. D. Williamson, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service in cooperation with Iowa Agriculture and Home Economics Experiment Station; Cooperative Extension Service, Iowa State University; and Department of Soil Conservation, State of Iowa

JOHNSON COUNTY is in the east-central part of Iowa (fig. 1). It has a total area of 396,837 acres or 619 square miles. Iowa City, in the center of county, is the county seat and the largest city. In 1977, Iowa City had a population of about 49,000.

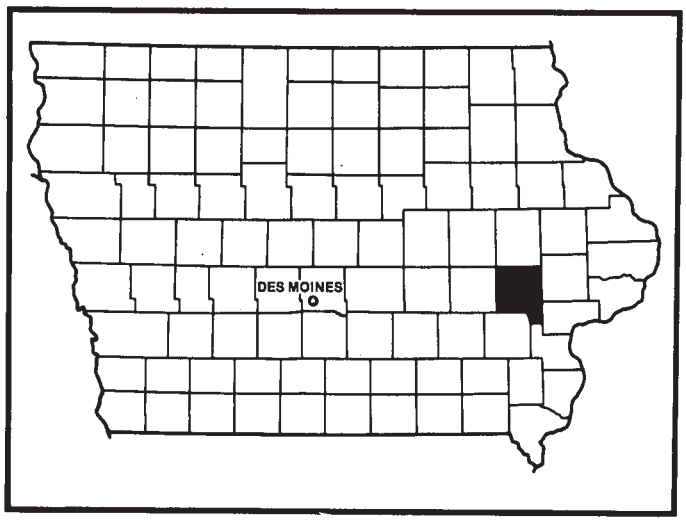

Figure 1.—Location of Johnson County in Iowa.

The county is in the Middle Western Upland Plains of the Central Lowlands. It is drained by two rivers that carry drainage water south-eastward toward the Mississippi River. The Iowa River is the principal watercourse. Together with its tributaries, it drains 95 percent of the county. The Cedar River and its tributaries drain the northeastern corner of the county.

The topography of the county is characterized by a generally rolling land surface. The greatest relief occurs in areas adjacent to the major watercourses. A few areas in the county have a dominantly level landscape, but they are not extensive. The highest altitude, about 900 feet, is in the northwestern corner of the county. The lowest altitude, about 615 feet, is in the southeastern part of the county where the Iowa River crosses the county border.

The first soil survey of Johnson County was published in 1919 (*18*). This survey updates the first survey and provides additional information and larger maps that show more detail.

general nature of the survey area

This section gives general information concerning the county. It discusses settlement; farming; transportation, industry, and markets; and climate.

settlement

The boundaries of Johnson County were established in 1837 by the Wisconsin Territorial Legislature. The county was named for Colonel Richard Johnson, who became Vice-President of the United States in 1836. The first settlers came generally from Indiana. In 1837, John Gilbert set up the first trading post in the county in Lucas Township.

The population of Johnson County was about 75,000 in 1974.

farming

Farming is the main economic enterprise in Johnson County. Although the number of farms has been decreasing in recent years, the size of the individual farm has generally increased. According to the 1977 Assessors Annual Farm Census in Iowa, there were 1,550 farms in Johnson County, of which about 344,700 acres were used for farming. The average farm was about 223 acres.

Cash grain and livestock production are almost equally important as sources of farm income. Corn, soybeans, oats, hay, and pasture are the principal crops. Corn is the principal row crop, and the acreage planted to corn has increased steadily in the past few years. Beef cattle and hogs are the main livestock raised.

transportation, industry, and markets

Federal, State, and county highways throughout Johnson County serve as routes for traffic and transportation of farm products. U.S. Highway 6 and Interstate 80 cross the county from east to west, and U.S. Highway 218 and State Highway 1 traverse the county from north to south. Interstate 380 connects Iowa City to Cedar Rapids. In addition, many gravel and asphalt county roads serve the farms with means of access to trading centers throughout the year. Railroads and motor freight lines also serve as mediums of access to the trading centers.

Although most areas in Johnson County are used for farming, the areas around Iowa City are becoming increasingly urbanized and used for industrial purposes. The University of Iowa is in Iowa City.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Johnson County is cold in winter and hot in summer. Occasionally, there are cool spells in summer. Precipitation during the winter frequently occurs as snowstorms. During the summer, warm moist air moves in from the south and precipitation is chiefly showers, which are often heavy. Total annual rainfall is normally adequate for corn, soybeans, and small grains.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Iowa City in the period 1951 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 24 degrees F, and the average daily minimum temperature is 15 degrees. The lowest temperature on record, which occurred at Iowa City on January 28, 1963, is -24 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Iowa City on July 27, 1955, is 101 degrees.

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

The total annual precipitation is 34 inches. Of this, 24 inches, or 70 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 6.91 inches at Iowa City on July 14, 1962. Thunderstorms occur on about 50 days each year, and most occur in summer.

Average seasonal snowfall is 29 inches. The greatest snow depth at any one time during the period of record was 22 inches. On an average of 21 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

Tornadoes and severe thunderstorms strike occasionally. These storms are local and of short duration, and result in sparse damage in narrow belts. Hailstorms occur at times during the warmer part of the year in irregular patterns and in relatively small areas.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent

material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas called associations that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations 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.

Descriptions of the general soil map units follow.

areas dominated by soils formed in silty materials; on uplands

The five associations in this group make up about 63 percent of the county. The nearly level to gently sloping soils are well suited to cultivated crops. The steep and very steep soils are poorly suited to cultivated crops. They are better suited to pasture or trees.

The principal management concerns are controlling erosion, improving fertility, and maintaining tilth. The less sloping soils are well suited to terracing, farming on the contour, and stripcropping. Returning crop residue or regularly adding other organic material helps to improve fertility, increase the infiltration of water, and improve tilth.

1. Fayette-Downs association

Gently sloping to very steep, well drained soils formed in loess

This association consists of soils on connected ridgetops and on side slopes (fig. 2). It is dissected by drainageways and streams, which form fingerlike networks throughout the area. Limestone crops out in a few places, especially in those areas adjacent to major streams. Slopes range from 2 to 40 percent.

This association makes up about 20 percent of the county. It is about 80 percent Fayette soils, 4 percent Downs soils, and 16 percent soils of minor extent.

The well drained Fayette and Downs soils are gently sloping and moderately sloping on ridgetops and moderately sloping to very steep on side slopes.

Typically, the surface layer of the Fayette soils is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is brown, friable silty clay loam, and the lower part is dark yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In cultivated areas, the surface layer is dark grayish brown, friable silt loam about 8 inches thick.

Typically, the surface layer of the Downs soils is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 47 inches thick. The upper part is brown, friable silty clay loam, and the lower part is dark yellowish brown and yellowish brown, mottled, friable silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and yellowish brown, friable silt loam.

Of minor extent in this association are the Arenzville, Chelsea, Lamont, Lindley, and Nodaway soils. The Arenzville and Nodaway soils are along streams and waterways. The strongly sloping and moderately steep Chelsea and Lamont soils are adjacent to streams and formed in eolian sand. The Lindley soils are on side slopes and at the base of steep slopes and formed in glacial till.

In this association many areas on ridgetops and some areas on side slopes are cultivated. Corn and soybeans are the main row crops, and alfalfa, red clover, and bromegrass are the main forage crops. Because of the slope, however, a large part of this association is in permanent pasture or woodland.

The gently sloping areas of Downs and Fayette soils are suited to row crops, but the steeper areas are subject to erosion. The steeper Fayette soils are better suited to permanent pasture or woodland. The main concerns of management are controlling water erosion and maintaining tilth and fertility.

2. Tama-Downs association

Gently sloping to strongly sloping, well drained soils formed in loess

This association consists of soils on broad, upland ridgetops and on long side slopes that are dissected by

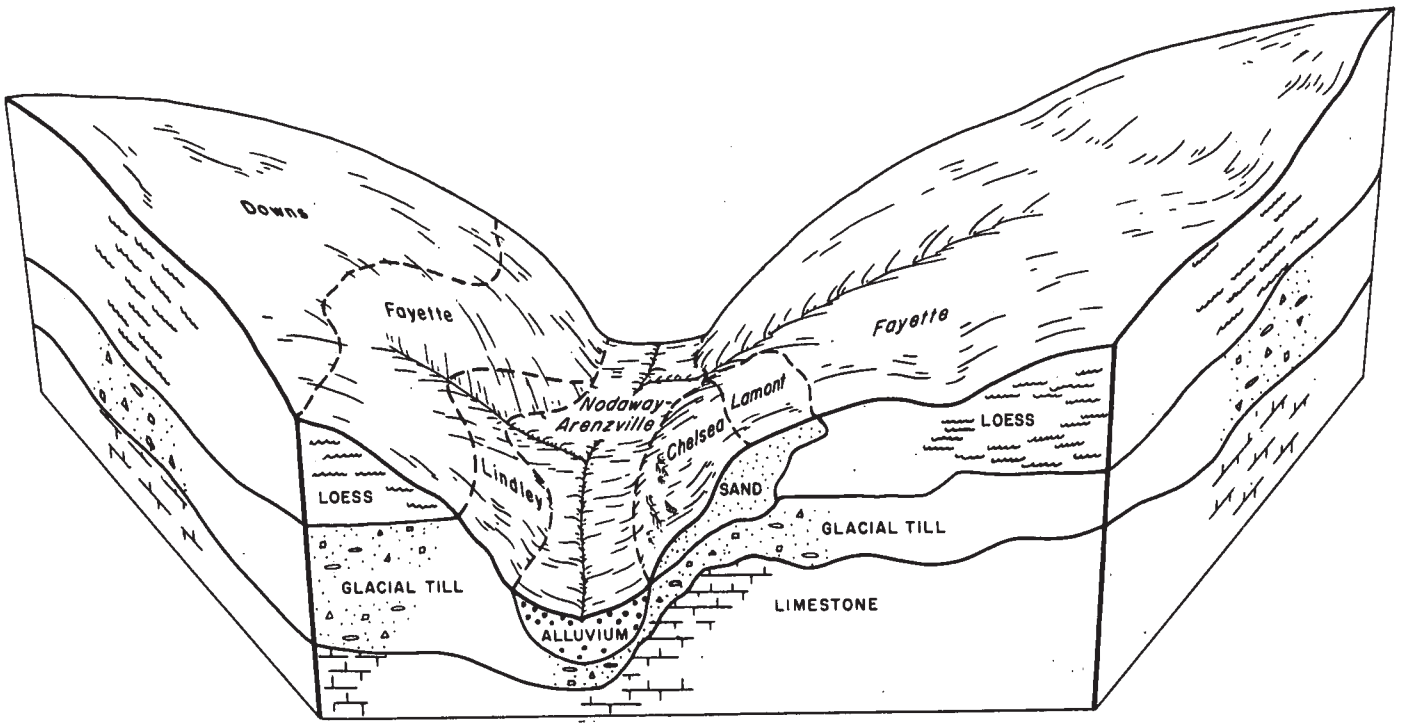

Figure 2.—Typical pattern of soils and parent material in the Fayette-Downs association.

many drainageways (fig. 3). Slopes range from 2 to 14 percent.

This association makes up about 12 percent of the county. It is about 69 percent Tama soils, 17 percent Downs soils, and 14 percent soils of minor extent.

The well drained Tama and Downs soils are gently sloping and moderately sloping on broad ridgetops and moderately sloping and strongly sloping on side slopes. The strongly sloping Downs soils commonly occupy side slopes below the moderately sloping Tama soils.

Typically, the surface layer of the Tama soils is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam, and the lower part is dark yellowish brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable silt loam.

Typically, the surface layer of the Downs soils is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 47 inches thick. The upper part is brown, friable silty clay loam, and the lower part is dark yellowish brown and yellowish brown, mottled, friable silt loam. The substratum to a depth of about 60 inches is mottled light brownish gray and yellowish brown, friable silt loam.

Of minor extent in this association are the Atterberry, Colo, Ely, Garwin, Kenyon, and Muscatine soils. The Atterberry and Garwin soils are nearly level on upland flats and gently sloping at heads of drainageways and bases of slopes. Atterberry soils are somewhat poorly drained, and Garwin soils are poorly drained. The nearly level Colo soils are in drainageways. The gently sloping Ely soils are on foot slopes directly above the drainageways. The Kenyon soils are on convex side slopes below the Tama soils. The nearly level to gently sloping, somewhat poorly drained Muscatine soils are on upland flats.

Corn and soybeans are grown extensively on the soils in this association. The gently sloping areas of Tama soils are well suited to row crops, but the more sloping areas of Tama and Downs soils are susceptible to erosion. Generally, the more sloping soils are eroded and contain less organic matter than the gently sloping Tama soils. The main concerns of management are controlling water erosion and maintaining tilth and fertility.

3. Tama-Garwin-Muscatine association

Nearly level to moderately sloping, well drained, poorly drained, and somewhat poorly drained soils formed in loess

This association consists of soils on broad, upland ridgetops and on side slopes (fig. 4). Waterways throughout this association are smooth and broad. Slopes range from 0 to 9 percent.

This association makes up about 12 percent of the county. It is about 52 percent Tama soils, 21 percent Garwin soils, 16 percent Muscatine soils, and 11 percent soils of minor extent.

The well drained Tama soils are gently sloping on broad, upland ridgetops and moderately sloping on side slopes. The poorly drained Garwin soils are nearly level on broad flats and at heads of concave drainageways. The somewhat poorly drained Muscatine soils are nearly level to gently sloping on areas adjacent to Garwin soils.

Typically, the surface layer of the Tama soil is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam, and the lower part is dark yellowish brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable silt loam.

Typically, the surface layer of the Garwin soil is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 12 inches thick. The subsoil is about 28 inches thick. The upper part is grayish brown and olive gray, mottled, friable silty clay loam, and the lower part is light olive gray, mottled, friable silt loam. The substratum to a depth of about 60 inches is light olive gray, mottled, friable silt loam.

Typically, the surface layer of the Muscatine soil is black silt loam about 7 inches thick. The subsurface layer is black and very dark brown, friable silty clay loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is very dark grayish brown, friable silty clay loam, the middle part is dark grayish brown, mottled, friable silty clay loam, and the lower part is grayish brown, mottled, friable silty clay loam and silt loam. The substratum to a depth of about 60 inches is light brownish gray, mottled, friable silt loam.

Of minor extent in this association are the Atterberry, Colo, Ely, Sperry, and Walford soils. The Atterberry soils

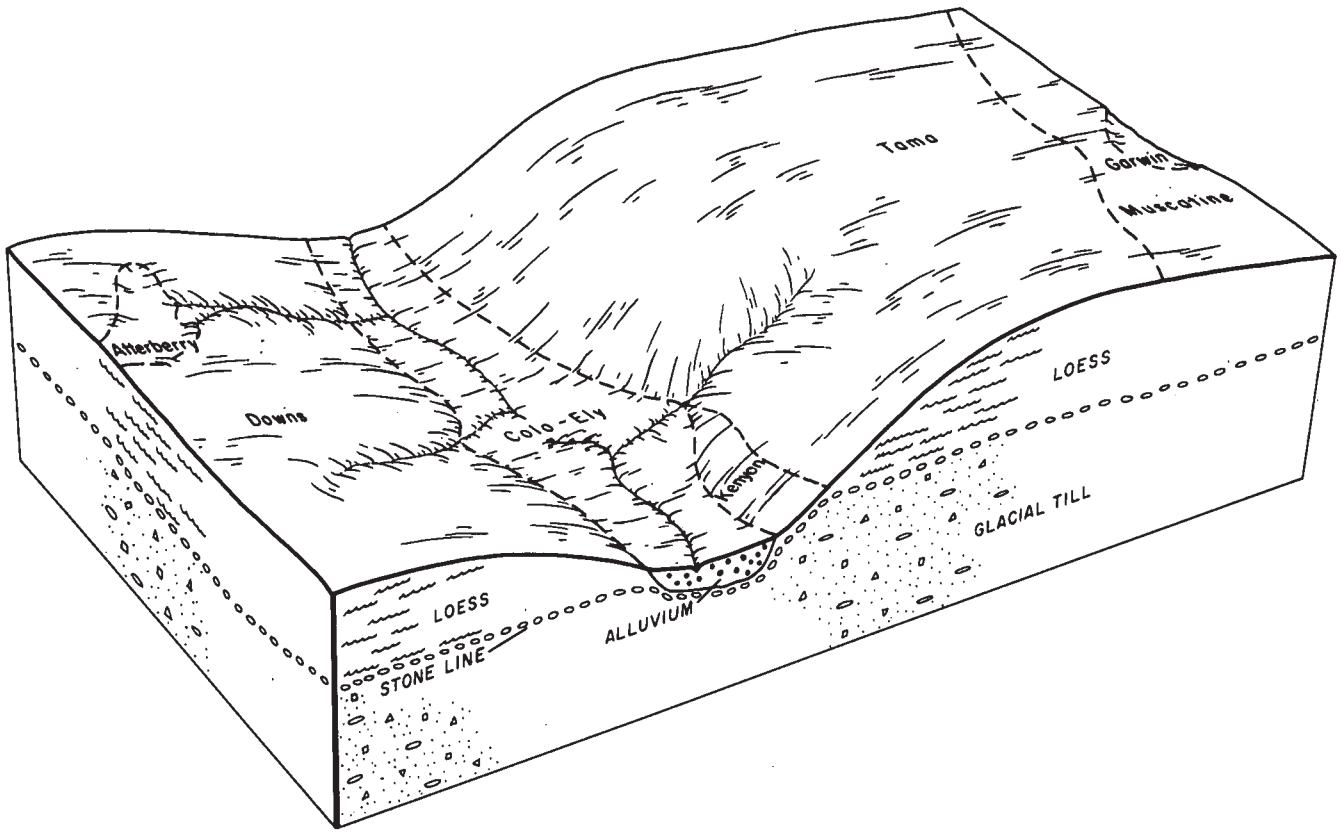

Figure 3.—Typical pattern of soils and parent material in the Tama-Downs association.

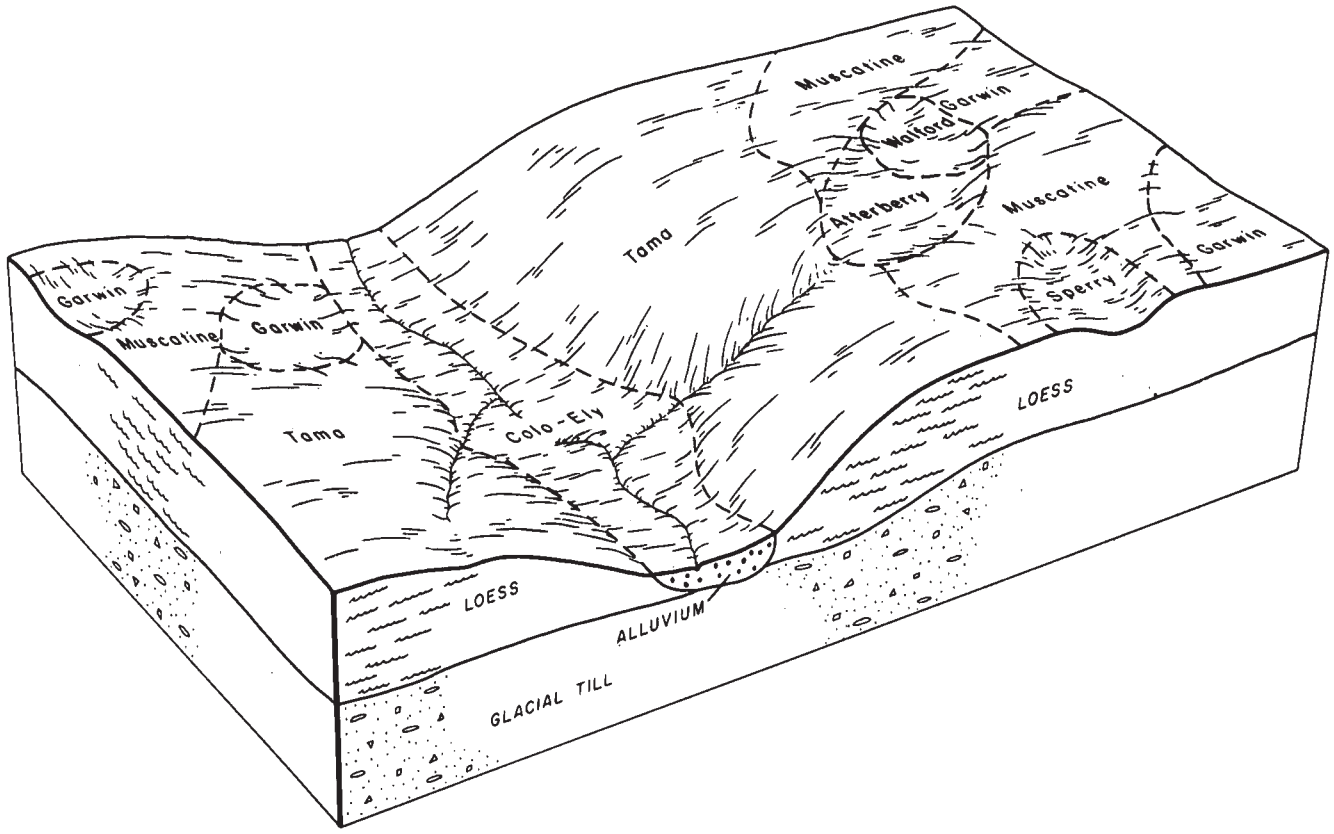

Figure 4.—Typical pattern of soils and parent material in the Tama-Garwin-Muscatine association.

are nearly level on upland flats and gently sloping at heads of drainageways and at the bases of slopes. Atterberry and Walford soils have lighter colored A horizons than Muscatine and Garwin soils. The Colo and Ely soils are in drainageways and on foot slopes. The nearly level Sperry and Walford soils are in depressions and isolated potholes. The Sperry soils are very poorly drained.

The major soils of this association are well suited to row crops. Corn and soybeans are grown extensively. The main concerns of management are controlling water erosion and maintaining tilth and fertility. The installation of tile is needed in some of the more poorly drained areas.

4. Ladoga-Otley-Mahaska association

Nearly level to moderately sloping, moderately well drained and somewhat poorly drained soils formed in loess

This association consists of soils on broad, upland flats and on ridges and side slopes (fig. 5). Slopes range from 0 to 9 percent.

This association makes up about 7 percent of the county. It is about 27 percent Ladoga soils, 8 percent Otley soils, 7 percent Mahaska soils, and 58 percent soils of minor extent.

The Ladoga and Otley soils are moderately well drained. Both soils are gently sloping on broad ridgetops and moderately sloping on side slopes. The somewhat poorly drained Mahaska soils are nearly level on broad, upland flats and divides.

Typically, the surface layer of the Ladoga soil is very dark brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam, and the lower part is brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is mottled brown and light brownish gray, firm silty clay loam.

Typically, the surface layer of the Otley soil is black silty clay loam about 8 inches thick. The subsurface layer is very dark brown to very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 28 inches thick. The upper part is brown, firm silty clay loam, the middle part is yellowish brown, mottled, firm

silty clay loam, and the lower part is mottled yellowish brown, grayish brown, and strong brown, firm silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, mottled, friable silt loam.

Typically, the surface layer of the Mahaska soil is black silty clay loam about 7 inches thick. The subsurface layer is black to very dark gray silty clay loam about 14 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, friable silty clay loam, and the middle and lower parts are grayish brown and olive gray, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is light olive gray, mottled, friable silt loam.

Of minor extent in this association are the Clinton, Colo, Ely, Givin, and Taintor soils. The gently sloping Clinton soils are on narrow ridgetops in areas of steeper topography. They have lighter colored A horizons than Ladoga soils. The nearly level Colo soils are in drainageways, and the gently sloping Ely soils are on foot slopes directly above the drainageways. The Givin and Taintor soils are in nearly level to slightly depressional areas on upland flats. Givin soils have a lighter colored A horizon than Mahaska soils, and Taintor soils are poorly drained.

Most of the soils in this association are used for cultivated crops. Corn and soybeans are grown intensively. The main concerns of management are controlling water erosion and maintaining tilth and fertility. The installation of tile may be needed in some of the soils of minor extent. The moderately sloping soils are more susceptible to erosion than the gently sloping and nearly level soils.

5. Clinton-Ladoga association

Moderately sloping to strongly sloping, moderately well drained soils formed in loess

This association consists of soils on side slopes (fig. 6). It is dissected by drainageways and streams, which form fingerlike networks throughout the area. Slopes range from 5 to 14 percent.

This association makes up about 12 percent of the county. It is 31 percent Clinton soils, 23 percent Ladoga soils, and 46 percent soils of minor extent.

The Clinton and Ladoga soils are moderately well drained. Both soils are moderately sloping on narrow,

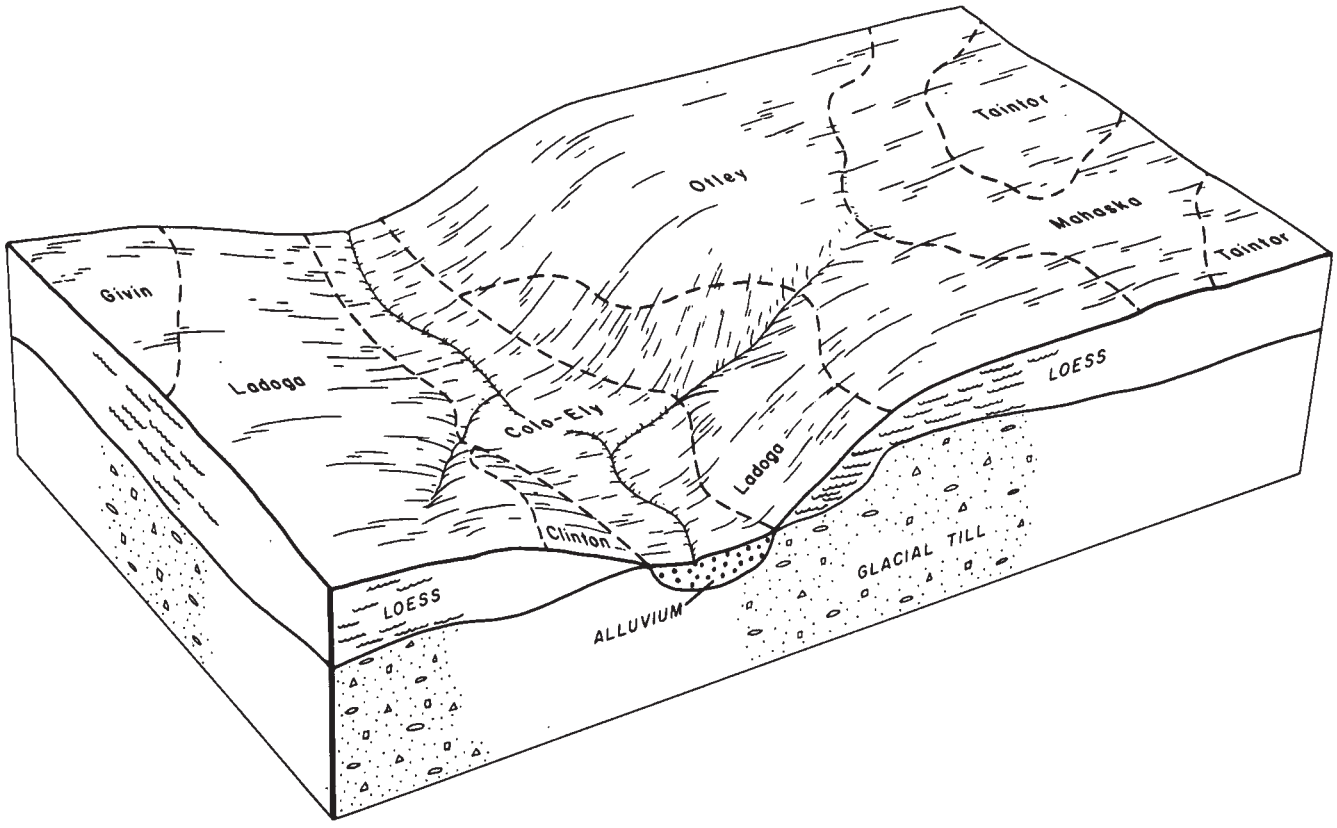

Figure 5.—Typical pattern of soils and parent material in the Ladoga-Otley-Mahaska association.

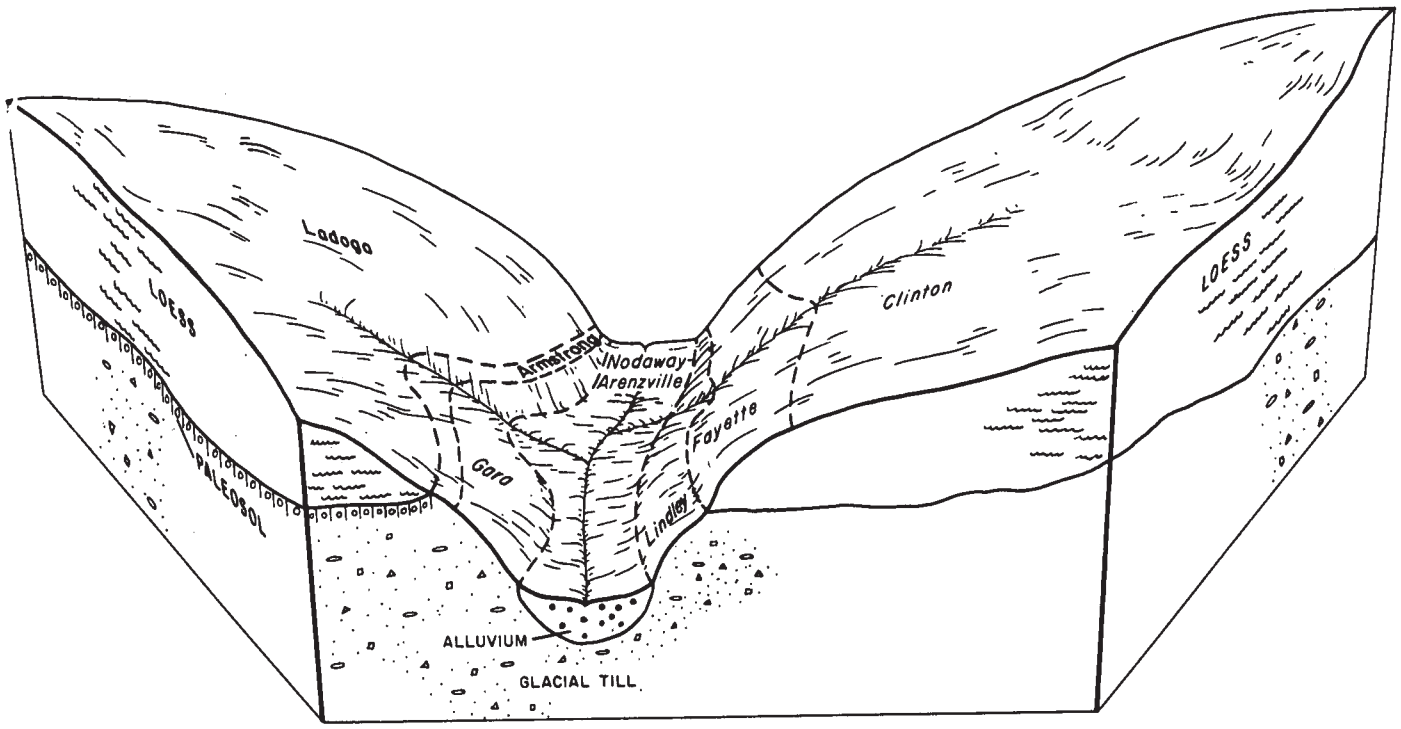

Figure 6.—Typical pattern of soils and parent material in the Clinton-Ladoga association.

upland ridges and strongly sloping on convex side slopes.

Typically, the surface layer of the Clinton soil is dark grayish brown silt loam about 7 inches thick. It is mixed, in places, with dark yellowish brown subsoil. The subsoil is about 32 inches thick. The upper part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable silt loam.

Typically, the surface layer of the Ladoga soil is very dark brown silt loam somewhat mixed with brown subsoil. It is about 7 inches thick. The subsoil is about 33 inches thick. The upper part is brown, friable silty clay loam, and the lower part is brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is mottled brown and light brownish gray, firm silty clay loam.

Of minor extent in this association are the Arenzville, Armstrong, Fayette, Gara, Lindley, and Nodaway soils. The Arenzville and Nodaway soils are along streams and waterways. The Armstrong soils, which formed in reddish, fine textured glacial till, are on shoulders of convex side slopes, and the Fayette soils, which formed in loess, are on moderately steep to very steep side slopes. Fayette soils have less clay in the subsoil than Clinton soils. The Gara and Lindley soils, which formed in loamy glacial till, are on strongly sloping to steep side slopes.

In this association, many of the moderately sloping to strongly sloping soils are cultivated, but the steeper soils are generally used for permanent pasture or woodland. Corn and soybeans, in rotation with grass and hay, are the main crops. The main concerns of management are controlling water erosion and maintaining tilth and fertility. Generally, areas that are cultivated are eroded and have a lower content of organic matter than the uncultivated areas.

areas dominated by soils formed in sandy, loamy, and silty materials; on uplands

The two associations in this group make up about 9 percent of the county. The nearly level to very steep soils are moderately suited to cultivated crops. The sandy soils and strongly sloping to very steep soils are poorly suited to cultivated crops. They are better suited to pasture and woodland.

The principal management concerns are controlling wind erosion and water erosion and improving drainage and fertility. Many soils in this group are droughty. Returning crop residue to the surface or regularly adding other organic material helps to improve fertility, increase the infiltration of water, and reduce erosion. The sandy soils are not well suited to terracing; contouring and stripcropping, however, help to reduce erosion.

6. Chelsea-Lamont-Fayette association

Moderately sloping to very steep, well drained and excessively drained soils formed in loess or windblown sandy and loamy deposits

This association consists of sandy, loamy, and silty soils mainly along the bluffs and breaks of the major rivers. The landscape is dunelike. Slopes range from 2 to 40 percent.

This association makes up about 8 percent of the county. It is about 30 percent Chelsea soils, 25 percent Lamont soils, 25 percent Fayette soils, and 20 percent soils of minor extent.

The excessively drained Chelsea soils and well drained Lamont soils are gently sloping on upland ridges and strongly sloping to moderately steep on side slopes. The well drained Fayette soils are moderately sloping on ridgetops and moderately steep to very steep on side slopes.

Typically, the surface layer of the Chelsea soil is very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. It is underlain by a subsurface layer that is dark grayish brown, dark brown, and yellowish brown, loose fine sand about 36 inches thick. Below this, to a depth of 60 inches or more is yellowish brown, loose fine sand that has bands of brown sandy loam about 1 inch thick.

Typically, the surface layer of the Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin bands of brown loamy sand.

Typically, the surface layer of the Fayette soil is very dark gray silt loam about 3 inches thick. It is covered with about 1/2 inch of leaf litter. The subsurface layer is dark grayish brown and brown silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is brown, friable silty clay loam, and the lower part is dark yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

Of minor extent in the association are the Dickinson, Sparta, Tama, Walford, and Waukegan soils. The Walford soils are in pothole depressions or in drainageways. The Dickinson, Sparta, and Waukegan soils are on ridgetops and side slopes and have darker A horizons than the major soils. The Tama soils formed in silty material and also have darker A horizons.

The sandy soils in this association are droughty and are susceptible to wind erosion and water erosion. Although a few areas are planted to soybeans and corn, most of the areas are used for woodland or pasture. The main concerns of management are controlling water erosion and wind erosion and maintaining fertility.

7. Sparta-Udolpho-Waukegan association

Nearly level to strongly sloping, excessively drained, well drained, and somewhat poorly drained or poorly drained soils formed in windblown sands and in loamy or silty deposits

This association consists of sandy, loamy, and silty soils on uplands and high terraces. It is at a lower elevation than the Chelsea-Lamont-Fayette association but at a higher elevation than the Nodaway-Lawson-Waukee association. Slopes range from 0 to 14 percent.

This association makes up about 1 percent of the county. It is about 20 percent Sparta soils, 11 percent Udolpho soils, 7 percent Waukegan soils, and 62 percent soils of minor extent.

The excessively drained Sparta soils are gently sloping to strongly sloping. They are in dunelike positions. The somewhat poorly drained and poorly drained Udolpho soils are nearly level. The well drained Waukegan soils are very gently sloping and gently sloping.

Typically, the surface layer of the Sparta soil is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown loamy fine sand about 20 inches thick. The subsoil is dark yellowish brown, loose loamy fine sand about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Typically, the surface layer of the Udolpho soil is very dark brown loam about 7 inches thick, and the subsurface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 19 inches thick. The upper part is dark grayish brown, mottled, friable loam, the middle part is grayish brown and light brownish gray, mottled, friable loam, and the lower part is grayish brown, mottled, very friable sandy loam. The substratum to a depth of about 60 inches is brown to pale brown loamy sand and sand.

Typically, the surface layer of the Waukegan soil is very dark brown silt loam about 8 inches thick, and the subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is brown and dark yellowish brown, friable silty clay loam about 23 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand and sand.

Of minor extent in this association are the Bolan, Coland, Dickinson, and Watseka soils. The Bolan and Dickinson soils have less content of clay in the A horizon than the major soils and are on ridges and side slopes. The poorly drained Coland soils are in drainageways, and the somewhat poorly drained Watseka soils are in nearly level areas.

Most of the soils in this association are used for cultivated crops, but some small areas are in permanent pasture. The main concerns of management are droughtiness late in the growing season, wind erosion on the sandy soils, and wetness in the Udolpho soil during spring.

areas dominated by soils formed in loess or loamy surficial materials and in the underlying glacial till; on uplands

The two associations in this group make up about 13 percent of the county. The very gently sloping to strongly sloping soils are well suited to cultivated crops. The very gently sloping and gently sloping soils are suited to continuous row cropping.

If subsurface drainage is used, more timely field operations are possible on the somewhat poorly drained and poorly drained soils. Other management concerns are controlling soil erosion, maintaining tilth, and improving fertility. Contouring, terracing, stripcropping, and rotation of row crops with oats and hay reduce erosion. Returning crop residue to the surface or regularly adding other organic material helps to improve fertility and maintain tilth.

8. Bassett-Kenyon-Dinsdale association

Gently sloping to strongly sloping, moderately well drained and well drained soils formed in loamy or silty materials and in the underlying glacial till

This association consists of soils on broad, upland ridges and on side slopes that are dissected by many drainageways (fig. 7). Slopes range from 2 to 14 percent.

This association makes up about 9 percent of the county. It is about 46 percent Bassett soils, 14 percent Kenyon soils, 8 percent Dinsdale soils, and 32 percent soils of minor extent.

The moderately well drained Bassett soils are gently sloping on ridgetops and strongly sloping on convex side slopes. The Kenyon soils are moderately well drained, and the Dinsdale soils are well drained and moderately well drained. Both Kenyon and Dinsdale soils are gently sloping on ridgetops and moderately sloping on side slopes.

Typically, the surface layer of the Bassett soil is very dark gray and very dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 2 inches thick. The subsoil is about 42 inches thick. The upper part is brown, friable loam, the middle part is yellowish brown, firm loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam.

Typically, the surface layer of the Kenyon soil is black loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 11 inches thick. The subsoil is about 35 inches thick. The

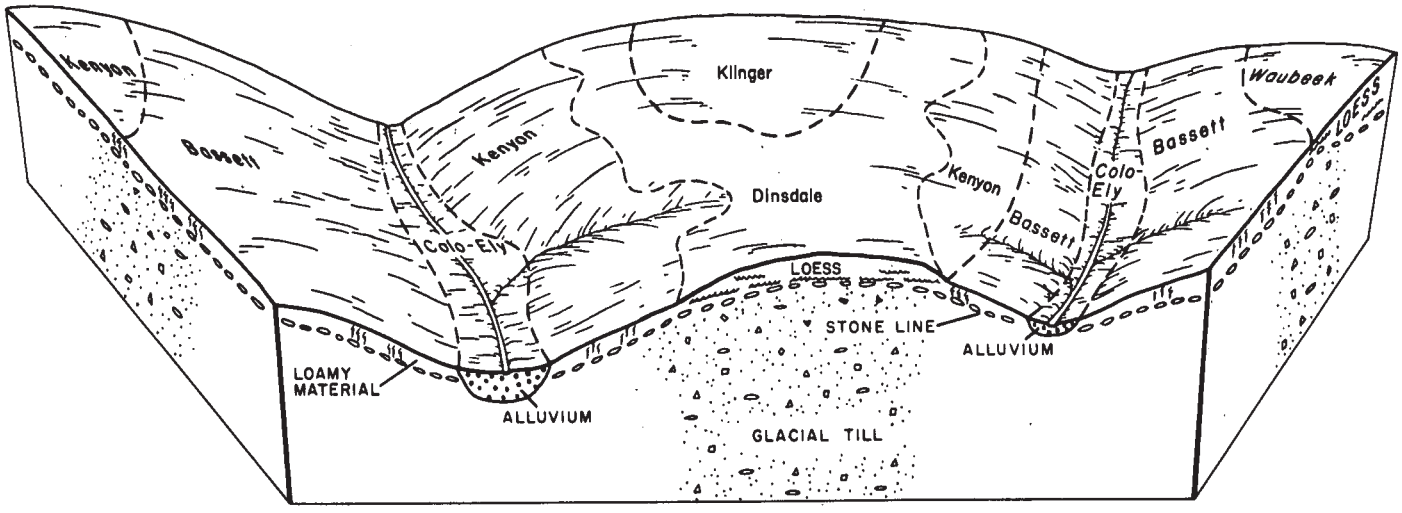

Figure 7.—Typical pattern of soils and parent material in the Bassett-Kenyon-Dinsdale association.

upper part is dark yellowish brown, friable loam that grades to yellowish brown, firm loam, and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, grayish brown, and light gray, firm, calcareous loam.

Typically, the surface layer of the Dinsdale soil is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark brown silty clay loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, brown, and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, friable loam. The substratum to a depth of about 60 inches is mottled yellowish brown and light grayish brown, calcareous loam.

Of minor extent in this association are the Colo, Ely, Klinger, and Waubeek soils. The poorly drained Colo soils are in upland drainageways and along streams. The Ely soils are in upland drainageways and on foot slopes. The somewhat poorly drained Klinger soils are on upland flats and at slightly concave heads of drainageways. The Waubeek soils are gently sloping on ridgetops and moderately sloping on side slopes. They have a thinner, darker surface layer than Dinsdale soils.

Corn and soybeans are grown intensively on the soils in this association. The gently sloping major soils are well suited to row crops, but the more sloping major soils are susceptible to erosion. The main concerns of management are controlling water erosion and maintaining tilth and fertility.

9. Dinsdale-Klinger-Franklin association

Very gently sloping to moderately sloping, well drained to somewhat poorly drained soils formed in loess and in the underlying glacial till

This association consists of soils on upland flats and on convex, upland ridges and side slopes (fig. 8). These soils formed in loess and glacial till. Slopes range from 1 to 9 percent.

This association makes up about 4 percent of the county. It is about 23 percent Dinsdale soils, 10 percent Klinger soils, 10 percent Franklin soils, and 57 percent soils of minor extent.

The well drained and moderately well drained Dinsdale soils are gently sloping on ridgetops and moderately sloping on side slopes. The somewhat poorly drained Klinger and Franklin soils are very gently sloping and gently sloping on broad divides or in slightly concave areas downslope.

Typically, the surface layer of the Dinsdale soil is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark brown silty clay loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, brown, and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, friable loam. The substratum to a depth of about 60 inches is mottled yellowish brown and light grayish brown, calcareous loam.

Typically, the surface layer of the Klinger soil is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, friable silty clay loam, the middle part is grayish brown, mottled, friable silty clay loam, and the lower part is mottled yellowish brown and grayish brown, firm loam. In places a stone line is at the boundary between the silty clay loam and the loam. Sand lenses also are common at the junction of the silty clay loam and the loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, firm loam.

Typically, the surface layer of the Franklin soil is very dark gray silt loam about 7 inches thick, and the subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is dark grayish brown, friable silty loam and silty clay loam, and the lower part is mottled grayish brown and yellowish brown, firm loam. Sand lenses are common at the junction of the silty clay loam and the loam. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray, firm loam.

Of minor extent in this association are the Ansgar, Bassett, Colo, Ely, Garwin, Kenyon, Maxfield, and Waubeek soils. The poorly drained Ansgar soils are in depressions and at heads of drainageways. The moderately well drained Bassett and Waubeek soils are on convex ridges and side slopes. The poorly drained Colo soils are in upland drainageways and along streams. The Ely soils are in upland drainageways and on foot slopes. The Garwin and Maxfield soils are in flat areas on uplands or in broad drainageways. The poorly drained Garwin soils formed entirely in loess. The Kenyon soils are on convex ridges and side slopes. The moderately well drained Kenyon soils formed in loamy sediment overlying glacial till.

The major soils are well suited to row crops. Corn and soybeans are grown intensively. The main concerns of management are controlling water erosion and maintaining tilth and fertility. The installation of tile is needed in some of the more poorly drained areas.

areas dominated by soils formed in silty, loamy, or clayey materials; on low stream benches and bottom lands

The two associations in this group make up about 15 percent of the county. These soils are used for row crops, hay, woodland, and pasture, or they are left idle for floodwater storage. Nearly all of the soils are subject to flooding or ponding.

The main concerns of management in the Nodaway-Lawson-Waukee association are improving drainage, reducing flooding, and improving fertility. Subsurface

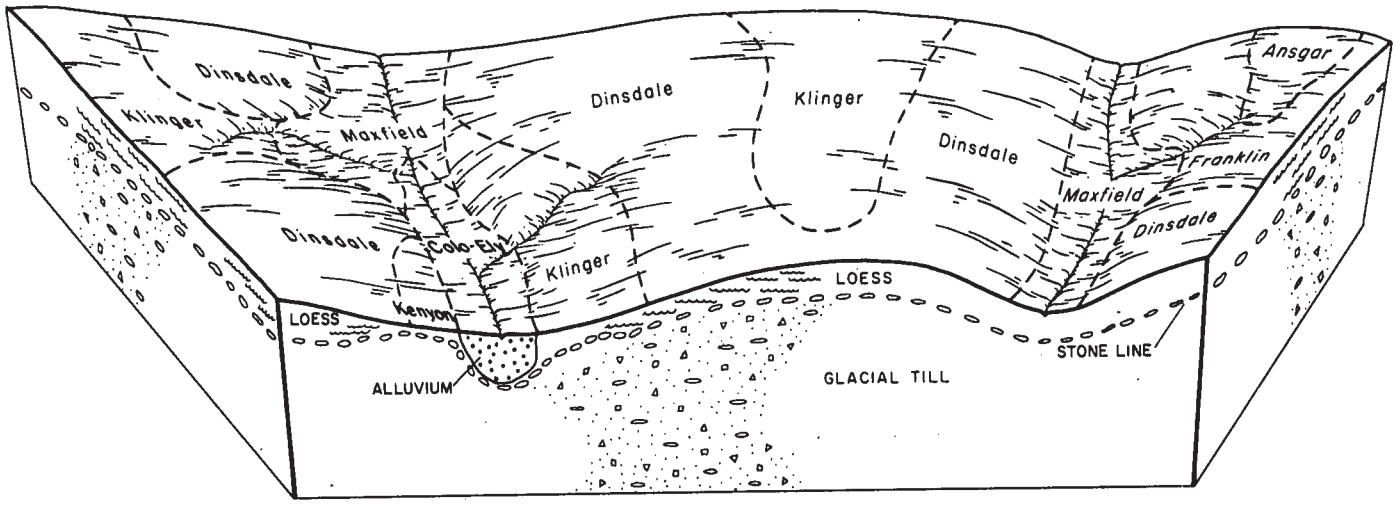

Figure 8.—Typical pattern of soils and parent material in the Dinsdale-Klinger-Franklin association.

drains function well if suitable outlets are available. Returning crop residue to the surface or the regular addition of other organic material into the plow layer helps improve the fertility of these soils. The Fluvaquents, ponded, association is generally not suited to cultivated crops, hay, or pasture except in very dry years when the water level in the Coralville Reservoir storage area is limited to the permanent pool level. It is better suited to wetland plants, trees, and to use as habitat for wildlife.

10. Nodaway-Lawson-Waukee association

Nearly level, well drained to somewhat poorly drained soils formed in silty or loamy alluvium

This association consists of silty, sandy, or loamy soils on low stream benches and bottom lands. Slopes range from 0 to 2 percent.

This association makes up about 10 percent of the county. It is about 23 percent Nodaway soils, 15 percent Lawson soils, 8 percent Waukee soils, and 54 percent soils of minor extent.

The Nodaway soils are moderately well drained, the Lawson soils are somewhat poorly drained, and the Waukee soils are well drained. All of these soils are nearly level on alluvial flood plains.

Typically, the surface layer of the Nodaway soil is very dark grayish brown silt loam about 6 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, dark grayish brown, and grayish brown, stratified, friable silt loam.

Typically, the surface layer of the Lawson soil is black silt loam about 7 inches thick. The subsurface layer is black to very dark grayish brown silt loam about 24 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, mottled silt loam.

Typically, the surface layer of the Waukee soil is very dark brown loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 12 inches thick. The subsoil is about 19 inches thick. The upper part is dark brown and brown, friable loam, and the lower part is dark yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, loose, loamy sand and sand.

Of minor extent in this association are the Bremer, Coland, Sparta, Spillville, and Udolpho soils. The nearly level, poorly drained Bremer soils are on low stream benches. The Coland and Spillville soils are along streams and waterways and contain more sand than the Nodaway and Lawson soils. The nearly level to gently sloping, excessively drained Sparta soils are on benches along the major streams. The nearly level, somewhat poorly drained or poorly drained Udolpho soils are on stream benches.

In this association the soils in the bottom lands are suited to row crops but are subject to periodic flooding. Many areas have been cleared and cultivated crops are grown, but other areas are still in woodland or permanent pasture. The soils on the benches are in cultivation, but a few small areas are in permanent pasture. The main concerns of management for soils in the bottom lands are the hazard of flooding, the high water table, and droughtiness in areas that are sandy. The main concerns of management for soils on the

benches are droughtiness, the fluctuating water table, and the maintenance of tilth and fertility.

11. Fluvaquents association

Nearly level, poorly drained and very poorly drained soils formed in loamy, silty, and clayey alluvium

This association consists of soils on bottom lands within the Coralville Reservoir water storage area. It consists of old channels, small oxbow ponds, sloughs, and low natural river levees. Slopes range from 0 to 2 percent.

This association makes up about 5 percent of the county. It is 30 percent Fluvaquents, ponded, 18 percent water, and 52 percent soils of minor extent.

Fluvaquents, ponded, consists of soils that are highly stratified. They are made up of soil material that has been recently deposited by the river.

Of minor extent in this association are the Coland, Nodaway, Sparta, Spillville, Waukee, and Zook soils. The poorly drained Coland soils and the moderately well drained Nodaway and Spillville soils are along the stream channels. The excessively drained Sparta soils and the well drained Waukee soils are on low stream benches. The poorly drained Zook soils are in slight depressions on the lower part of the flood plain.

This association is subject to periodic ponding for long periods. Most areas support water-loving plants, and some areas at a slightly higher elevation support trees that tolerate wetness. This association generally is not suited to cultivated crops, pasture, or hay except in very dry years when the water level in the storage area is limited to the permanent pool. It is better suited to wetland plants and trees and to use as habitat for wildlife.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Tama silt loam, 2 to 5 percent slopes, is one of several phases in the Tama series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Colo-Ely complex, 2 to 5 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, limestone quarry, is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Descriptions of the detailed soil map units follow.

7—Wiota silt loam, 1 to 3 percent slopes. This very gently sloping, well drained and moderately well drained soil is on convex slopes on low stream benches that lie a few feet above the flood plain. Some low lying areas are subject to flooding. Individual areas range from 5 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is black and very dark grayish brown silt loam about 13 inches thick. The subsoil is about 29 inches thick. The upper part is brown, friable silty clay loam, and the lower part is dark yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is dark yellowish brown, friable silt loam.

This Wiota soil is moderately permeable, and surface runoff is slow. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Diversion terraces can be placed on the soils upslope to help protect this soil from sedimentation. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, increase water infiltration, and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction,

increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is in capability class I.

11B—Colo-Ely complex, 2 to 5 percent slopes. These gently sloping soils are along small streams and narrow upland drainageways. The Colo soil is subject to flooding. Individual areas range from 10 to 150 acres and are irregular in shape. This map unit is about 50 percent Colo soils and 30 percent Ely soils. The poorly drained Colo soils are nearer the stream channels or waterways than Ely soils and are bordered by a band of somewhat poorly drained Ely soils.

Typically, the surface layer of the Colo soil is black silty clay loam about 11 inches thick. The subsurface layer is black and very dark gray silty clay loam about 31 inches thick. The substratum to a depth of about 60 inches is dark gray, firm silty clay loam that has brown and yellowish brown mottles.

Typically, the surface layer of the Ely soil is black silt loam about 7 inches thick. The subsurface layer is black to very dark gray, friable silty clay loam about 19 inches thick. The mottled subsoil is about 29 inches thick. The upper part is grayish brown, friable silty clay loam, and the lower part is light brownish gray, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, mottled, friable silt loam.

Included with these soils in mapping are small areas of Ackmore and Zook soils. The Ackmore soils are along the outer edge of the drainageways. Zook soils are near the middle of the waterways. These soils make up about 20 percent of the map unit.

The Colo and Ely soils are moderately permeable, and surface runoff is slow. These soils have a seasonal high water table. Available water capacity is high. The content of organic matter in the Colo soil is about 5 to 7 percent in the surface layer, and that of the Ely soil is about 5 or 6 percent. Reaction in the surface layer of the Ely soil ranges from medium acid to neutral as a result of local liming practices. Reaction in the Colo soil generally is neutral. The Colo subsoil is medium in available phosphorus and very low in available potassium. The Ely soil is very low in available phosphorus and potassium. The Colo soil is in fair tilth. The Ely soil is in good tilth that is easy to maintain.

Most drained areas of this map unit are cultivated. They are cropped with the surrounding soils because they generally are too small and narrow and too irregular in shape to be cropped separately. These soils are well suited to corn, soybeans, and small grains, and to grasses and legumes for hay and pasture. Some areas remain in grassed waterways. These areas generally are wet because of overflow and seepage from more sloping soils. Drainageways that have a high concentration of water need to be maintained in grass to help prevent gullying. Tile drainage is needed on each side of some drainageways to remove excess water. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Contouring and terracing are beneficial in some places. Returning crop residue or the regular addition of other organic material helps to improve fertility and maintain good tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soils are wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are in capability subclass IIw.

41—Sparta loamy fine sand, 0 to 2 percent slopes. This nearly level, excessively drained soil is on stream benches and uplands. Individual areas range from 5 to 25 acres and are irregular in shape.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown loamy fine sand about 29 inches thick. The subsoil is dark yellowish brown, loose loamy fine sand about 12 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand.

This Sparta soil is rapidly permeable, and surface runoff is slow. Available water capacity is low. The content of organic matter is about 1 to 1.5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated, but some areas are used for pasture and hay. This soil is poorly suited to corn, soybeans, and small grains. It is droughty and low in fertility and is better suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, soil blowing is a hazard. Newly seeded crops on this soil and adjoining soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is suited to trees. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs

to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVs.

41B—Sparta loamy fine sand, 2 to 5 percent slopes. This gently sloping, excessively drained soil is on stream benches and uplands. Individual areas range from 2 to 60 acres and are irregular in shape.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown loamy fine sand about 20 inches thick. The subsoil is dark yellowish brown, loose loamy fine sand about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

This Sparta soil is rapidly permeable, and surface runoff is slow. Available water capacity is low. The content of organic matter is about 1 to 1.5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated, but some areas are used for pasture and hay. This soil is poorly suited to corn, soybeans, and small grains. It is droughty and low in fertility and is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, water erosion and soil blowing are hazards. Newly seeded crops on this soil and adjoining soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil loss. In places, contouring is beneficial in controlling erosion. Terraces are poorly suited because they are difficult to construct and maintain on this highly erosive soil. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVs.

41C—Sparta loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil is on convex ridges and side slopes on uplands. A few areas are on stream benches. Individual areas range from 5 to 30 acres and are irregular in shape.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown loamy fine sand about 16 inches thick. The subsoil is dark yellowish brown loamy fine sand about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In places the surface layer is lighter in color and not so thick. These areas are lower in content of organic matter and have less fertility. In other areas the surface layer is sandy loam.

This Sparta soil is rapidly permeable, and surface runoff is medium. Available water capactiy is low. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are used for pasture, but some areas are cultivated. This soil is poorly suited to corn, soybeans, and small grains. It is droughty and low in fertility and is better suited to grasses and legumes for hay and pasture. Crop yields are low even in years of average rainfall. If this soil is used for cultivated crops, water erosion and soil blowing are hazards. Newly seeded crops on this soil and adjoining soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and winter cover crops help prevent soil loss. In places contouring may be beneficial in controlling erosion. Terraces are poorly suited because they are difficult to construct and maintain on this highly erosive soil. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVs.

41D—Sparta loamy fine sand, 9 to 18 percent slopes. This strongly sloping to moderately steep, excessively drained soil is on convex side slopes or narrow, convex ridges in uplands. Individual areas range from 5 to 25 acres and are irregular in shape.

Typically, the surface layer is very dark brown loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown loamy fine sand about 13 inches thick. The subsoil is dark yellowish brown loamy fine sand about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In places the surface layer is lighter

colored and not so thick. These areas are lower in content of organic matter and have less fertility. In other areas the surface layer is sandy loam.

This Sparta soil is rapidly permeable, and surface runoff is medium. Available water capacity is low. The content of organic matter is 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are used for pasture, but a few areas are cultivated. This soil is generally unsuitable for cultivation because of the severe erosion hazard. If this soil is cultivated, young seedlings commonly are damaged by blowing sand and, in addition, the soil itself is exposed to severe erosion.

The use of the soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition. The carrying capacity of this pasture is low.

This soil is moderately suited to trees. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass VIs.

43—Bremer silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low stream benches on high second bottoms along major streams. This soil is subject to flooding. Individual areas range from 10 to 70 acres. Areas generally are broad, but some are linear in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black silty clay loam about 11 inches thick. The subsoil is about 19 inches thick. The upper part is very dark gray, firm silty clay loam and grades to dark grayish brown and gray in the lower part. The substratum to a depth of about 60 inches is gray silty clay loam.

Included with this soil in mapping are small, concave depressions that are higher in content of clay and are subject to ponding. These areas make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Bremer soil, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 7 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil generally is low in available phosphorus and potassium. This soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated. If drained, this soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Flooding is a hazard if the soil is used for cultivated crops. Artificial drainage is needed to lower the water table and to improve the timeliness of field operations. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

54—Zook silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low flood plains. This soil is subject to flooding. Individual areas range from 10 to 100 acres and are irregular or elongated in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark gray silty clay loam about 32 inches thick. The subsoil is dark gray, firm silty clay about 14 inches thick. The substratum to a depth of about 60 inches is dark gray and gray, firm silty clay loam. In places the substratum is loam or sandy loam.

This Zook soil is slowly permeable, and surface runoff is very slow to ponded. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 7 percent in the surface layer. Reaction typically is medium acid to neutral in the upper part of the surface layer and neutral in the lower part and substratum. The subsoil is low in available phosphorus and very low in available potassium. The soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated, but some areas are in permanent pasture. If drained and protected from flooding, this soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. However, spring plowing and planting may be delayed because of flooding. Artificial drainage is needed to lower the water table and to improve the timeliness of field operations. Areas that are frequently flooded, cut up by old stream channels, or poorly drained generally are used for pasture or hay. Using diversion terraces may be beneficial in protecting the soil from flooding. Returning crop residue or regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

63B—Chelsea loamy fine sand, 2 to 5 percent slopes. This gently sloping, excessively drained soil is on convex ridges and side slopes in uplands or on stream benches. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. It is underlain by a subsurface layer that is dark grayish brown, brown, and dark yellowish brown, loose fine sand about 36 inches thick. Below this to a depth of 60 inches or more is yellowish brown, loose fine sand with 1-inch bands of brown sandy loam. In cultivated areas the surface layer is dark grayish brown to dark brown loamy fine sand about 7 inches thick. In places the surface layer is sandy loam.

This Chelsea soil is rapidly permeable, and surface runoff is medium. Available water capacity is low. The content of organic matter is about 0.5 to 1 percent in the surface layer. In uncultivated areas reaction of the surface layer typically is slightly acid to strongly acid, but in cultivated areas it ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are in pasture or trees, but some areas are cultivated. This soil is poorly suited to corn, soybeans, and small grains and also to grasses and legumes for hay and pasture because it is droughty and low in fertility. If the soil is used for cultivated crops, erosion is a hazard. In addition, new seedlings on this soil and adjacent soils are damaged by blowing sand. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil blowing. Terraces are poorly suited because they are difficult to construct and maintain on this unstable soil. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVs.

63C—Chelsea loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil is on moundlike ridges and side slopes on uplands. A few areas are on stream benches. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. It is underlain by a subsurface layer that is dark grayish brown, brown, and yellowish brown, loose fine sand about 33 inches thick. Below this to a depth of 60 inches or more is yellowish brown, loose fine sand with 1-inch bands of brown sandy loam. In cultivated areas the surface layer is dark grayish brown to brown loamy fine sand about 7 inches thick. In places the surface layer is sandy loam.

This Chelsea soil is rapidly permeable, and surface runoff is medium. Available water capacity is low. The content of organic matter is about 0.5 to 1 percent in the surface layer. In uncultivated areas reaction in the surface layer typically is slightly acid to strongly acid, but in cultivated areas it ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are in pasture or trees, but a few areas are cultivated. This soil is poorly suited to corn, soybeans, and small grains and also to grasses and legumes for hay and pasture because it is droughty and low in fertility. If the soil is used for cultivated crops, erosion is a hazard. In addition, new seedlings on this soil and adjacent soils are damaged by blowing sand. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil blowing. Terraces are poorly suited because they are difficult to construct and maintain on this unstable soil. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVs.

63E—Chelsea loamy fine sand, 9 to 18 percent slopes. This strongly sloping to moderately steep, excessively drained soil is on convex ridges and side slopes in uplands. Individual areas range from 5 to 60 acres and are irregular in shape.

Typically, the surface layer is very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. It is underlain by a subsurface layer that is dark grayish brown, brown, and yellowish brown, loose fine sand

about 25 inches thick. Below this to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam. In cultivated areas the surface layer is brown loamy fine sand about 7 inches thick.

Included with this soil in mapping are small areas in which limestone is close to or is on the surface. These areas make up 5 to 10 percent of the unit.

This Chelsea soil is rapidly permeable, and surface runoff is medium. Available water capacity is low. The content of organic matter is about 0.5 to 1 percent in the surface layer. In uncultivated areas reaction in the surface layer typically is slightly acid to strongly acid, but in cultivated areas it ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are in trees, but a few areas are in pasture or are cultivated. This soil is not suited to cultivated crops because it is droughty and low in fertility and the hazard of erosion is severe.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass VIs.

65D2—Lindley loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex nose slopes and side slopes. Individual areas range from 5 to 10 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown and brown loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part is brown and yellowish brown, friable loam, and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm loam. In places the surface layer is thinner, lighter, and lower in content of organic matter.

Included with this soil in mapping are soils formed in reddish clay that are lower in content of organic matter than Lindley soil and are in poor tilth. These soils are on the upper part of the slope and make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Lindley soil, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer, and reaction ranges from very strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated, but some areas are in permanent pasture or hay. Although the soil is moderately suited to corn, soybeans, and small grains, it is better suited to grasses and legumes for hay and pasture or to trees. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In places where needed, grassed waterways help prevent gully erosion. In places contouring is beneficial in controlling erosion. The use of terraces is only moderately satisfactory because the soil is steep and has moderately slow permeability, and the subsoil is firm. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees. Careful consideration should be given to the location of trails or roads used in logging on this soil so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because this soil is sloping, the operation of farm machinery is somewhat difficult.

This soil is in capability subclass IVe.

65E2—Lindley loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, moderately well drained soil typically is in a narrow band around side slopes. Individual areas range from 5 to 40 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown and brown loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is brown and yellowish brown, friable loam, and the middle part is yellowish brown, firm loam and clay loam that has light brownish gray and strong brown mottles in the lower part. The lower part of the subsoil is yellowish brown, firm clay loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm loam. In places the

surface layer is thinner, lighter, and lower in content of organic matter.

Included with this soil in mapping are soils formed in reddish clay that are lower in content of organic matter and are more difficult to plow and cultivate. These soils are located upslope and make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Lindley soil, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1.0 percent in the surface layer, and reaction ranges from very strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in fair tilth. It puddles readily when wet and becomes hard and cloddy when dry.

Most areas of this soil were formerly cultivated but are now used for permanent pasture or hay. This soil is not suited to cultivated crops because it is too steep for the use of ordinary farm machinery. It is better suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a severe hazard.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and the soil in good condition.

This soil is moderately suited to trees. However, hardwood seedlings require a site of better quality than conifers and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited to eroded or formerly cultivated soils. If areas of this Lindley soil are planted to trees, careful consideration should be given to the location of trails or roads used in logging so that the hazard of further erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slope of this soil is steep, some danger is involved in the operation of farm equipment. Special equipment can be used, but caution is needed in its operation. Planted seedlings do not survive well; consequently, the seedlings should be planted close together and thinned later to achieve the desired stand density.

This soil is in capability subclass VIe.

65F—Lindley loam, 18 to 25 percent slopes. This steep, moderately well drained soil is in a narrow band around side slopes or on convex nose slopes. Individual areas range from 10 to 60 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown loam about 3 inches thick. The subsurface layer is dark grayish brown to grayish brown loam about 4 to 6 inches thick. The subsoil is about 35 inches thick. The upper part is brown and yellowish brown, friable loam, and the middle part is yellowish brown, firm loam and clay loam that has light brownish gray and strong brown mottles in the lower part. The lower part of the subsoil is yellowish brown, firm clay loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm loam.

Included with this soil in mapping are soils formed in reddish clay that are lower in content of organic matter and are more difficult to plow and cultivate than Lindley soil. These soils are upslope and make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Lindley soil, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from very strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are in permanent pasture or trees. This soil is not suited to cultivated crops because of the hazard of erosion. It is better suited to grasses and legumes for hay and pasture.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and the soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Trees grow best on north- and east-facing, lower slopes and in coves. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour helps reduce soil erosion. In areas where erosion occurs, planted seedlings do not survive well; consequently, seedlings should be planted close together and thinned later to achieve the desired stand density. Because the slope of this soil is steep, some danger is involved in the operation of farm equipment. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass VIIe.

65F2—Lindley loam, 18 to 25 percent slopes, moderately eroded. This steep, moderately well drained soil is in narrow bands around side slopes and is dissected by gullies and drainageways. Individual areas range from 5 to 15 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown and yellowish brown loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable loam, and the middle part is yellowish brown, firm loam and clay loam that has light

brownish gray and strong brown mottles in the lower part. The lower part of the subsoil is yellowish brown, firm clay loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm loam. In places small areas of soil are steeper than this soil.

Included with this soil in mapping are soils formed in reddish clay that are lower in content of organic matter. These soils are upslope and make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Lindley soil, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from very strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium.

Most areas of this soil are in permanent pasture or trees. This soil is not suited to cultivated crops or to grasses and legumes for hay. It is better suited to permanent pasture and trees. If this soil is used for cultivated crops, damage from further erosion is a severe hazard. Renovation of pastures is difficult because the slope is steep.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to the production of upland oaks and conifers. Trees grow best on north- and east-facing, lower slopes and in coves. The use of a cover crop helps reduce the hazard of erosion if new timber stands are established, but the cover crop needs to be carefully managed to avoid competition with the seedlings.

Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion is reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Planted seedlings do not survive well in eroded areas; consequently, seedlings should be planted close together and thinned later to achieve the desired stand density. Because the slope of this Lindley soil is steep, some danger is involved in the operation of farm equipment. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass VIIe.

75—Givin silt loam, 0 to 2 slopes. This nearly level, somewhat poorly drained soil is in slight depressions on broad flats in loess covered uplands. Individual areas range from 5 to 90 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 41 inches thick. The upper part is dark grayish brown, friable silty clay loam, the middle part is brown or grayish brown, firm silty clay loam that has yellowish brown and strong brown mottles, and the lower part is mottled yellowish brown, grayish brown, and light brownish gray, firm silty clay loam. The substratum to a depth of about 60 inches is mottled yellowish brown, grayish brown, and light brownish gray, firm silty clay loam. In places the dark grayish brown or grayish brown subsurface layer has been mixed into the surface layer in plowing.

Permeability is moderately slow in this Givin soil, and surface runoff is slow. The soil has a seasonal high water table which occurs most commonly in spring. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. Reaction typically is medium acid but varies as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. The surface layer typically is in good tilth but tends to crust after heavy rains.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a slight hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. The installation of properly placed tile for drainage helps offset the seasonal high water table, which is of special concern in the spring. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay helps improve the permeability. Overgrazing or grazing when the soil is wet, however, causes surface compaction, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

76B—Ladoga silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridges and gentle side slopes in uplands. Individual areas range from 5 to 90 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam, and the lower part is brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is mottled brown and light brownish gray, firm silty clay loam.

Permeability is moderately slow in this Ladoga soil, and surface runoff is medium. Available water capacity is

high. The content of organic matter is about 2 to 3 percent in the surface layer. Reaction typically is slightly acid or neutral but varies as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. Most areas have uniform slopes and are well suited to contouring and terracing. Returning crop residue or the regular addition of other organic material helps improve fertility, control soil erosion, reduce crusting, and increase water infiltration.

The use of the soil for pasture or hay is an effective means of controlling erosion. Overgrazing, however, causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

76C2—Ladoga silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on knolls and convex side slopes that border upland drainageways. Individual areas range from 5 to 80 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. Brown subsoil material is mixed with the surface layer. The subsoil is about 33 inches thick. The upper part is brown, friable silty clay loam, the middle part is brown, firm silty clay loam that has yellowish brown and light brownish gray mottles, and the lower part is brown, firm silty clay loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is mottled brown and light brownish gray, firm silty clay loam.

Permeability is moderately slow in this Ladoga soil, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer. Reaction typically is slightly acid or neutral but varies as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay or pasture. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss, and grassed waterways help prevent gully erosion. Most areas are well suited to contouring and terracing. Returning crop residue or the regular addition of other organic material helps improve fertility, control erosion, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing, however, causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

76D2—Ladoga silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in uplands. Individual areas range from 10 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. Some brown subsoil material is mixed with the surface layer. The subsoil is about 30 inches thick. The upper part is brown, friable silty clay loam, the middle part is brown, firm silty clay loam that has yellowish brown and light brownish gray mottles, and the lower part is brown, firm silty clay loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is mottled brown and light brownish gray, firm silty clay loam.

Permeability is moderately slow in this Ladoga soil, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer. Reaction typically is slightly acid or neutral but varies as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss, and grassed waterways help prevent gully erosion. Most areas are well suited to contouring and terracing. Returning crop residue or the regular addition of other organic material helps improve fertility, control soil erosion, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion (fig. 9). Overgrazing, however, causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

80B—Clinton silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on narrow ridgetops and side slopes in uplands. Individual areas range from 5 acres to 75 acres or more and are irregular in shape.

Typically, the surface layer is dark grayish brown silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 7 inches thick. The subsoil is about 43 inches thick. The upper part is dark yellowish brown, friable silt loam, the middle part is yellowish brown, firm silty clay loam that has a few grayish brown and strong brown mottles, and the lower part is yellowish brown, friable silty clay loam that has a few grayish brown and strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has a few grayish brown and strong brown mottles.

Figure 9.—The use of Ladoga silt loam, 9 to 14 percent slopes, moderately eroded, for hay helps control erosion and reduce siltation in farm ponds.

Permeability is moderately slow in this Clinton soil, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay, pasture, and trees. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss, and grassed waterways help prevent gully erosion. In most places contouring and terracing are beneficial. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the reguiar addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability subclass IIe.

80C—Clinton silt loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on narrow ridgetops and side slopes in uplands. Individual areas range from 5 acres to 15 acres or more and are elongated and irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 7 inches thick. The subsoil is about 43 inches thick. The upper part is dark yellowish brown, friable silty clay loam, the middle part is yellowish brown, firm silty clay loam that has a few grayish brown and strong brown mottles, and the lower part is yellowish brown, friable silty clay loam that has a few grayish brown and strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has a few grayish brown and strong brown mottles.

Permeability is moderately slow in this Clinton soil, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are in pasture and woodland. This soil is suited to corn, soybeans, and small grains, and is well suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss, and grassed waterways help prevent gully erosion. In most places contouring and terracing are also beneficial in controlling erosion. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability subclass IIIe.

80C2—Clinton silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on ridgetops and side slopes in uplands. Individual areas range from 5 acres to 100 acres or more and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. Some dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 37 inches thick. The upper part is dark yellowish brown, friable silty clay loam, the middle part is yellowish brown, firm silty clay loam that has a few grayish brown and strong brown mottles, and the lower part is yellowish brown, friable silty clay loam that has a few grayish brown and strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has a few grayish brown and strong brown mottles.

Permeability is moderately slow in this Clinton soil, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 1.5 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains, and it is well suited to grasses and legumes for hay and pasture. If this soil

is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss, and grassed waterways help prevent gully erosion. In most places, contouring and terracing are beneficial in controlling erosion. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Hardwood seedlings require a site of better quality than conifers and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation needs to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

80D—Clinton silt loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on side slopes and some ridgetops in uplands. Individual areas range from 2 to 20 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark gray and grayish brown silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is dark yellowish brown, friable silty clay loam, the middle part is yellowish brown, firm silty clay loam that has a few grayish brown and strong brown mottles, and the lower part is yellowish brown, friable silty clay loam that has a few grayish brown and strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has a few grayish brown and strong brown mottles. If cultivated, the surface layer is dark grayish brown silt loam.

Permeability is moderately slow in this Clinton soil, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are in pasture and woodland. This soil is suited to corn, soybeans, and small grains and is well suited to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss, and grassed waterways help prevent gully erosion. In most places, contouring and terracing are beneficial in controlling erosion. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

80D2—Clinton silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on side slopes and some ridgetops in uplands. Individual areas range from 5 acres to 75 acres or more and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. Some dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 32 inches thick. The upper part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam that has a few grayish brown and strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has a few grayish brown and strong brown mottles.

Permeability is moderately slow in this Clinton soil, and surface runoff is medium to rapid. Available water capacity is high. The organic matter content is about 1 to 1.5 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and is well suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss, and grassed waterways help prevent gully erosion. In places contouring and terracing are also beneficial in controlling erosion. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular

addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Hardwood seedlings require a site of better quality than conifers and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation needs to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

80D3—Clinton silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on side slopes on the uplands. Individual areas range from 5 acres to 80 acres or more and are elongated and irregular in shape.

Typically, the surface layer is brown silty clay loam about 7 inches thick. Some dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 27 inches thick. The upper part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

Permeability is moderately slow in this Clinton soil, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in poor tilth. At times intense rainfall causes the surface soil to puddle, which results in increased runoff and retards plant growth.

Most areas of this soil are cultivated. This soil is moderately suited to row crops in rotation with small grain and with grasses and legumes for hay and pasture. If this soil is used for cultivated crops, further damage from erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss, and grassed waterways help prevent gully erosion. Waterways and gullies can be shaped and seeded. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Hardwood seedlings require a site of better quality than conifers and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation needs to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IVe.

83B—Kenyon loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on convex ridges and side slopes. Individual areas range from 5 to 100 acres and are long and irregular in shape.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 11 inches thick. The subsoil is about 35 inches thick. The upper part is dark yellowish brown, friable loam that grades to yellowish brown, firm loam, and the lower part is yellowish brown, firm loam that has grayish brown mottles. These mottles increase in number as depth increases. The substratum to a depth of about 60 inches is yellowish brown, grayish brown, and light gray, firm, calcareous loam. In places the surface layer is sandy.

This Kenyon soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. In most places contouring and terracing are also beneficial in controlling erosion. Fieldwork is slightly delayed in wet years. Adequate erosion control and drainage are difficult to provide on this soil; therefore, a combination of terracing and tile drainage is needed in places. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is black, very dark brown, or very dark grayish brown loam about 7 inches thick. Some dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 30 inches thick. The upper part is dark yellowish brown, firm loam that grades to yellowish brown, firm loam, and the lower part is yellowish brown, firm loam that has grayish brown mottles. These mottles increase in number as depth increases. The substratum to a depth of about 60 inches is yellowish brown, grayish brown, and light gray, firm, calcareous loam. In places the surface layer is thicker and darker and has a higher amount of organic matter. In other areas the surface layer is sandy.

This Kenyon soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In most places contouring and terracing are also beneficial in controlling erosion. Fieldwork is slightly delayed in wet years. Because adequate erosion control and drainage are difficult to provide on this soil, a combination of terracing and tile drainage is needed in some areas. Returning crop residue or the regular addition of other organic material helps improve fertility and tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

88—Nevin silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on benches along major streams and tributaries. This soil is subject to flooding. Individual areas range from 5 to 30 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 13 inches thick. The subsoil is about 24 inches thick. The upper part is dark grayish brown, friable silty clay loam, and the middle and lower parts are grayish brown, friable to firm silty clay loam that has yellowish brown or strong brown mottles. The substratum to a depth of about 60 inches is grayish brown silt loam that has yellowish brown mottles.

This Nevin soil is moderately permeable, and surface runoff is slow. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 4 to 6 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The placement of diversion terraces on adjacent, upland slopes protects this soil from runoff and siltation. Because of the seasonal high water table, the installation of tile drainage is needed to improve the timeliness of field operations. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

110B—Lamont fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in uplands and on stream benches. Individual areas range from 5 to 10 acres and are irregular in shape.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin brown bands of loamy sand. In places the surface layer is lower in content of organic matter.

Permeability is moderately rapid in the upper part of this Lamont soil and rapid in the lower part. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are cultivated, but a few areas are in pasture and trees. Because this soil is droughty, it

is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion and soil blowing are hazards. Newly seeded crops are sometimes damaged by blowing sand. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In places contouring is beneficial in controlling erosion. Terraces may be difficult to construct and maintain because this soil is unstable. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

110C—Lamont fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridges and side slopes in uplands and on stream benches. Individual areas range from 5 to 15 acres and are irregular in shape.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin, brown bands of loamy sand. In places the surface layer is lower in content of organic matter.

Permeability is moderately rapid in the upper part of this Lamont soil and rapid in the lower part. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are cultivated, but a few areas are in pasture and trees. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture because it is droughty. Water erosion and soil blowing are hazards if the soil is used for cultivated crops. Newly seeded crops are sometimes damaged by blowing sand. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In places contouring may be beneficial in controlling erosion. Terraces may be difficult to construct and maintain because this soil is unstable. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

110E—Lamont fine sandy loam, 9 to 18 percent slopes. This strongly sloping to moderately steep, well drained soil is on convex ridges and side slopes in uplands and on stream benches. Individual areas range from 5 to 15 acres and are irregular in shape.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 20 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown fine sand that has thin brown bands of loamy sand. In some places the surface layer is lower in content of organic matter.

Permeability is moderately rapid in the upper part of this Lamont soil and rapid in the lower part. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction typically is medium acid. If the soil is cultivated, however, reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are in pasture and trees, but a few areas are cultivated. This soil is generally unsuitable for cultivation because of the severe hazards of erosion and soil blowing.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings that are located outside the flood pool of the Coralville Reservoir survive and grow well if competing vegetation

is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

118—Garwin silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flats and in concave positions at the heads of drainageways in uplands. Individual areas range from 5 to 100 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 12 inches thick. The subsoil is about 28 inches thick. The upper part is grayish brown, friable silty clay loam that has light olive brown mottles, the middle part is olive gray, friable silty clay loam that has light olive brown and yellowish brown mottles, and the lower part is light olive gray, friable silt loam that has light olive brown mottles. The substratum to a depth of about 60 inches is light olive gray, friable silt loam that has yellowish brown mottles.

This Garwin soil is moderately permeable. Surface runoff is slow, and the soil is subject to ponding in low places for short periods. This soil has a seasonal high water table, and available water capacity is high. The content of organic matter is about 6 to 7 percent in the surface layer, and reaction in the surface layer and subsoil ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. The soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. However, artificial drainage may be needed to lower the seasonal high water table and improve the timeliness of field operations. Areas of this soil that are not adequately drained generally are used for pasture or hay. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

119—Muscatine silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad upland divides. Individual areas range from 5 to 80 acres and are irregular in shape.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is black and very dark brown, friable silty clay loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is very dark grayish brown, friable silty clay loam, the middle part is dark grayish brown, friable silty clay loam that has yellowish brown mottles, and the lower part is grayish brown, friable silty clay loam and silt loam that has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has yellowish brown and strong brown mottles. In places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of poorly drained Garwin soils that occupy slightly convex positions in depressions or drainageways. They make up 10 to 15 percent of the unit.

This Muscatine soil is moderately permeable, and surface runoff is slow. This soil has a seasonal high water table, which occurs most commonly in spring. Available water capacity is high. The content of organic matter is about 5 to 6 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The installation of tile drainage may promote the timeliness of field operations in years of more than normal rainfall. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

119B—Muscatine silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is at the head of upland drainageways and at the base of side slopes. It also occurs as slight knobs on nearly level areas. Individual areas range from 3 to 25 acres and are irregular in shape.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is black and very dark brown silty clay loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is very dark grayish brown, friable silty clay loam, the middle part is dark grayish brown, friable silty clay loam that has yellowish brown mottles, and the lower part is grayish brown, friable silty clay loam and silt loam that has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has yellowish brown and strong brown mottles. In places the surface layer is silty clay loam.

This Muscatine soil is moderately permeable, and surface runoff is medium. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 6 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. In most places contouring and terracing are beneficial in controlling erosion. In places tile is used to drain the head slopes of waterways, and this practice improves the timeliness of field operations in wet years. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

120B—Tama silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes. Individual areas range from 5 acres to several hundred acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles.

This Tama soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but some areas are in permanent pasture and hay. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. Most areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

120C—Tama silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes. Individual areas range from 5 to 50 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and very dark brown silt loam about 10 inches thick. The subsoil is about 24 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles.

This Tama soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but some areas are in permanent pasture and hay. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Most areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

120C2—Tama silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes. Individual areas range from 5 acres to several hundred acres and are elongated and irregular in shape.

Typically, the surface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. Some brown subsoil material is mixed with the surface layer. The subsoil is about 22 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles.

This Tama soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retards plant growth.

Most areas of this soil are cultivated, but a few areas are in pasture and hay. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Most areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

120D2—Tama silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes. Individual areas range from 5 to 25 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark brown and very dark grayish brown silt loam about 7 inches thick. Some brown subsoil material is mixed with the surface layer. The subsoil is about 20 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles. In places the surface layer is thicker and darker and has a higher content of organic matter.

This Tama soil is moderately permeable, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 2.0 to 2.5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retards plant growth.

Most areas of this soil are cultivated, but a few areas are in pasture or hay. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. Most areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

122—Sperry silt loam, 0 to 1 percent slopes. This slightly depressed to nearly level, very poorly drained or poorly drained soil is on broad divides. It is subject to ponding by runoff from adjacent areas. Individual areas range from 1 acre to 10 acres and are circular.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is very dark gray, dark grayish brown, gray, and light brownish gray silt loam about 6 inches thick. The subsoil is about 40 inches thick. The upper part is very dark gray, firm silty clay, the middle part is very dark gray and dark gray, firm silty clay that has yellowish brown, strong brown, and gray mottles, and the lower part is olive gray, firm silty clay loam that has strong brown mottles. The substratum to a depth of about 60 inches is olive gray silty clay loam.

This Sperry soil is slowly permeable, and surface runoff is very slow to ponded. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the

surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain, but the soil puddles readily after heavy rains if worked when wet.

Many areas of this soil are drained and cultivated. This soil is suited to corn and soybeans if drained. The installation of tile drainage is not satisfactory on all sites, however, and surface drainage is also needed. Because areas of this soil are small or irregular in shape, the cropping system used generally is determined by surrounding soils. Small isolated areas that are left idle in wet years become habitat for wildlife. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains and in narrow upland drainageways. It is subject to flooding. Individual areas range from 20 acres to several hundred acres and are irregular or elongated in shape.

Typically, the surface layer is black silty clay loam about 12 inches thick. The subsurface layer is black and very dark gray silty clay loam about 30 inches thick. The substratum to a depth of about 60 inches is dark gray, firm silty clay loam that has dark brown and yellowish brown mottles. In places the surface layer is silt loam. In other places sandy or gravelly soils are at a depth of more than 48 inches.

This soil is moderately permeable, and surface runoff is very slow to ponded. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 7 percent in the surface layer. Reaction typically is medium acid or neutral in the upper part of the surface layer and neutral in the lower part and substratum as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated, but some areas are in permanent pasture. If drained and protected from flooding, this soil is well suited to corn and soybeans and to grasses and legumes for hay and pasture. In some years spring plowing and planting are delayed because of flooding. In many places artificial drainage is needed to lower the seasonal high water table and to improve the timeliness of field operations. Areas that are frequently flooded, cut up by old stream channels, or not adequately drained generally are used for pasture or hay. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

133+—Colo silt loam, overwash, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains and along narrow, upland drainageways. It is subject to flooding. Individual areas range from 20 to 60 acres and are irregular or elongated in shape.

Typically, the surface layer is dark grayish brown silt loam 8 inches thick. The subsurface layer to a depth of 52 inches is dark grayish brown silt loam over black to very dark gray silty clay loam. The substratum to a depth of about 60 inches is dark gray, firm silty clay loam that has dark brown and yellowish brown mottles.

This Colo soil is moderately permeable, and surface runoff is very slow to ponded. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 3 to 5 percent in the surface layer. Reaction typically is neutral but is slightly acid or neutral in the substratum. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but some areas are in permanent pasture. If drained and protected from flooding, this soil is well suited to corn and soybeans and to grasses and legumes for hay and pasture. Spring plowing and planting may be delayed because of flooding. Artificial drainage is generally needed to lower the seasonal high water table. Because the surface layer of this soil is silt loam, plowing and preparation of the seedbed are less difficult than on other Colo soils. The use of diversion terraces constructed on soils upslope can protect this soil from siltation and runoff. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

135—Coland silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains and in narrow upland drainageways. It is subject to flooding. Individual areas range from 15 to 70 acres and are irregular or elongated in shape.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer to a depth of about 35 inches is black clay loam and black silty clay loam. The substratum to a depth of about 60 inches is gray and olive gray clay loam and very dark gray sandy loam.

Included with this soil in mapping are a few small areas southeast of Iowa City where the surface layer has large amounts of calcium carbonate. These areas make up 10 to 15 percent of the unit.

This Coland soil is moderately permeable, and surface runoff is very slow to ponded. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 7 percent in the surface layer. Reaction typically is slightly acid or neutral throughout. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in good tilth but puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated, but some areas are in permanent pasture. If drained and protected from flooding, this soil is well suited to corn and soybeans and to grasses and legumes for hay and pasture. Spring plowing and planting may be delayed because of flooding. Artificial drainage may be needed to lower the seasonal high water table and to improve the timeliness of field operations. Areas that are frequently flooded, cut up by old stream channels, or not adequately drained generally are used for pasture or hay. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

140—Sparta loamy fine sand, thick surface, 0 to 2 percent slopes. This nearly level, excessively drained soil is on stream benches and uplands. It receives runoff and sediment from surrounding areas. Individual areas range from 2 to 125 acres and are irregular in shape.

Typically, the surface layer is very dark brown loamy fine sand about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown loamy fine sand about 24 inches thick. The subsoil is about 13 inches thick and is very dark grayish brown, dark brown, and dark yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

This Sparta soil is rapidly permeable, and surface runoff is slow. Available water capacity is low. The content of organic matter is about 1 to 1.5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil are cultivated, but some areas are used for pasture and hay. This soil is suited to corn, soybeans, and small grains, but because it is droughty and low in fertility, it is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, soil blowing is a hazard. Newly seeded crops on this soil and adjacent soils can be damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings do not survive well because of the low available moisture; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVs.

141—Watseka loamy fine sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches or on uplands. Individual areas range from 10 to 100 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown loamy fine sand about 10 inches thick. The subsoil is mottled dark grayish brown, yellowish brown, light brownish gray, brown, and strong brown loamy fine sand about 18 inches thick. The substratum to a depth of about 60 inches is grayish brown sand that has yellowish brown and strong brown mottles. In places the substratum contains coarse sand and gravel.

This Watseka soil is rapidly permeable, and surface runoff is very slow. It has a seasonal high water table. Available water capacity is low. The content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from slightly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. The surface layer is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Droughtiness is a hazard during seasons of less than normal rainfall. This soil has a fluctuating water table that is moderately high in spring but drops rapidly during the growing season. In some

areas artificial drainage is beneficial during wet seasons, but the installation of tile may be difficult because of loose, water-bearing sand and gravel. If this soil is used for cultivated crops, soil blowing is a hazard. Newly seeded crops on this soil and adjoining soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage and grassed waterways help prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet or dry causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during adverse moisture conditions help to keep the pasture and soil in good condition.

This soil is in capability subclass IIIs.

152—Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is mainly on stream benches, but some areas are on uplands. This soil is subject to flooding. Individual areas range from 2 acres to more than 100 acres and are irregular in shape.

Typically, the surface layer is black loam about 6 inches thick. The subsurface layer is black and very dark gray loam about 11 inches thick. The subsoil is about 18 inches thick. The upper part is gray, mottled, friable loam, and the lower part is light olive gray, mottled, friable clay loam. The substratum to a depth of about 60 inches is grayish brown, loose coarse sand.

This Marshan soil is moderately permeable in the surface layer and subsoil and rapidly permeable in the substratum. Surface runoff is slow. This soil has a seasonal high water table. Available water capacity is moderate. The content of organic matter is about 4 to 8 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

In many areas of this soil, tile drainage has been installed and the soil is cultivated. The soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. For the production of row crops, however, artificial drainage is needed to lower the water table and to improve the timeliness of field operations. Establishing adequate drainage outlets and installing tile may be difficult undertakings on this soil because of loose, water-bearing sand and gravel. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

Areas of this soil that are not adequately drained generally are used for pasture or hay. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

160—Walford silt loam, 0 to 1 percent slopes. This slightly depressed to level, poorly drained soil is on upland divides. Individual areas range from 2 to 40 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is grayish brown and dark grayish brown, friable silty clay loam that has yellowish brown mottles, the middle part is grayish brown, firm silty clay loam that has strong brown mottles, and the lower part is mottled olive gray, brown, and yellowish brown, firm silty clay loam. The substratum to a depth of about 60 inches is mottled light olive gray, brown, and strong brown, friable silt loam. In places soil that has light colored overwash ranging from 8 to 20 inches in thickness is at the head of some upland drainageways.

This Walford soil is slowly permeable, and surface runoff is slow to ponded. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in good tilth.

Many areas of this soil are cultivated, but a few areas are in permanent pasture or used as wildlife habitat. If drained, this soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. Some areas of this soil are ponded for short periods, and crops are drowned out in some years. Drainage by using open ditches together with the installation of a tile drainage system may be needed to successfully lower the seasonal high water table. Undrained areas generally remain idle. Some small, isolated areas are left idle in wet years or used as wildlife habitat. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIw.

161—Walford-Atterberry silt loams, 1 to 3 percent slopes. This map unit consists of very gently sloping, somewhat poorly drained and poorly drained soils at the heads of drainageways and at the base of slopes in uplands. Individual areas range from 5 to 75 acres and are irregular in shape. This unit is 60 percent Walford soils and 35 percent Atterberry soils. The soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the poorly drained Walford soil is very dark gray silt loam about 8 inches thick. The subsurface layer is grayish brown silt loam about 5 inches thick. The mottled subsoil is about 43 inches thick. The upper part is grayish brown and dark grayish brown, friable silty clay loam, the middle part is grayish brown, firm silty clay loam, and the lower part is olive gray, brown, and yellowish brown silty clay loam. The substratum to a depth of about 60 inches is mottled light olive gray, brown, and strong brown, friable silt loam.

Typically, the surface layer of the somewhat poorly drained Atterberry soil is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam, the middle part is grayish brown and gray, friable silty clay loam, and the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has yellowish brown mottles.

Included with these soils in mapping are small areas of Garwin soils at the heads of drainageways. These soils make up about 5 percent of the map unit.

The Walford soil is slowly permeable, and the Atterberry soil is moderately permeable. Both soils have a seasonal high water table. Surface runoff is slow to ponded on the Walford soil and slow on the Atterberry soil. In both soils, the available water capacity is high, the content of organic matter is about 2 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil of the Walford soil is very low in available phosphorus and potassium, and the subsoil of the Atterberry soil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain in these soils, but heavy rainfall causes the Walford soils to puddle readily if worked when wet.

Most areas of this map unit are cultivated, but a few areas are in permanent pasture. These soils are suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. They have a seasonal high water table, which occurs most commonly in spring. Some areas are subject to ponding for short periods. These soils receive runoff and seepage from the soils upslope, and tile drainage generally needs to be installed to remove the seepage and to permit timely field operations. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If these soils are used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This map unit is in capability subclass IIw.

162B—Downs silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on narrow ridges and broad divides. Individual areas range from 10 to 100 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 47 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silt loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is mottled, light brownish gray and yellowish brown, friable silt loam.

This Downs soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, however, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. Some areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

162C—Downs silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridgetops and long, convex side slopes. Individual areas range from 5 to 20 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 45 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silt loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is mottled, light brownish gray, and yellowish brown, friable silt loam.

This Downs soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are in pasture or trees. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. Some areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

162C2—Downs silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridgetops and convex side slopes. Individual areas range from 10 to 50 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. Some dark brown subsoil material is mixed with the surface layer. The subsoil is about 42 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is dark yellowish brown and yellowish brown, friable silt loam that has light brownish gray mottles. The substratum to a depth of about 60 inches is mottled, light brownish gray and yellowish brown, friable silt loam.

The Downs soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1.5 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and is well suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, further damage from erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. Some areas are well suited to contouring and terracing because slopes are long and uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

162D2—Downs silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes. Individual areas range from 10 to 60 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. Some brown subsoil material is mixed with the surface layer. The subsoil is about 36 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown

and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silt loam that has some light brownish gray mottles. The substratum to a depth of about 60 inches is mottled, light brownish gray and yellowish brown, friable silt loam. In a few small areas the surface layer is thicker and darker and is higher in content of organic matter.

This Downs soil is moderately permeable, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. The soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, further damage from erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Some areas are well suited to contouring and terracing. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

163B—Fayette silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is in convex positions on moderately wide ridgetops. Individual areas range from 5 to 100 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. It is covered with about 1/2-inch of leaf litter. The subsurface layer is dark grayish brown and brown silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In cultivated areas the surface layer is dark grayish brown, friable silt loam about 8 inches thick. In places small areas of this soil are nearly level.

This Fayette soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. In many areas slopes that are long enough and smooth enough to be terraced are farmed on the contour. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, increase water infiltration, and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

163C—Fayette silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas range from 5 to 100 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In cultivated areas the surface layer is dark grayish brown silt loam about 7 inches thick.

This Fayette soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil

is high in available phosphorus and very low in available potassium. This soil typically is in good tilth.

Most areas of this soil are in trees or permanent pasture. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. In most places contouring and terracing are beneficial in controlling erosion. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

163C2—Fayette silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas range from 5 to 150 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown and brown silt loam about 7 inches thick. Some brown and dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 32 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

This Fayette soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 0.5 to 1 percent in the surface layer. Reaction ranges from strongly acid to neutral. The subsoil generally is high in available phosphorus and very low in available potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, further damage from erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In a few areas slopes are long enough and smooth enough to be terraced and farmed on the contour. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

163D—Fayette silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on convex side slopes and narrow ridgetops in uplands. Individual areas range from 5 to 40 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 6 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In cultivated areas part or all of the original subsurface layer is mixed into the surface layer.

This Fayette soil is moderately permeable, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are in trees or permanent pasture. This soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In many areas slopes are long enough and uniform enough to be terraced and farmed on the contour. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper

stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Most areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

163D2—Fayette silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas range from 20 to 200 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown and brown silt loam about 7 inches thick. Some brown and dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 30 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

This Fayette soil is moderately permeable, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated, but a few areas are in pasture. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, further damage from erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. Grassed waterways are needed to prevent the formation of gullies in areas where water concentrates. In many areas slopes are long enough and uniform enough to be terraced and farmed on the contour. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion (fig. 10). Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment

Figure 10.—The use of Fayette silt loam, 9 to 14 percent slopes, moderately eroded, for hay is an effective means of preventing excessive erosion.

of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Hardwood seedlings require a site of better quality than conifers and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation needs to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IIIe.

163D3—Fayette silty clay loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, well drained soil is on convex side slopes and narrow ridgetops. Individual areas range from 20 to 100 acres and are elongated and irregular in shape.

Typically, the surface layer is mixed, brown and dark yellowish brown silty clay loam about 7 inches thick. The subsoil is about 28 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

This Fayette soil is moderately permeable, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in poor tilth and becomes cloddy if worked when wet. Intense rainfall causes this soil to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated. This soil is suited to occasional row crops in rotation with small grains and to grasses and legumes for hay and pasture. However, it is better suited to hay and pasture. If the soil is used for cultivated crops, further damage from erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. Gullies and drainageways need to be reshaped and reseeded in places. In a few areas slopes are long enough and uniform enough to be terraced and farmed on the contour. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve the fertility and tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Hardwood seedlings require a site of better quality than conifers and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation needs to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IVe.

163E—Fayette silt loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on long, convex side slopes. Individual areas range from 10 to 50 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark gray silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 5 inches thick. The subsoil is about 30 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

This Fayette soil is moderately permeable, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are in permanent pasture or trees. This soil is suited to occasional row crops in rotation with small grains and to grasses and legumes for hay and pasture; it is, however, better suited to hay and pasture. If the soil is used for cultivated crops, erosion is a severe hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. Returning crop residue or the regular addition of other organic material helps improve the fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or

nearly on the contour reduces soil erosion. Because the slope of this soil is moderately steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass IVe.

163E2—Fayette silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes that are dissected by waterways. Individual areas range from 5 to 30 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown and brown silt loam about 7 inches thick. Some brown and dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 28 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

This Fayette soil is moderately permeable, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil were formerly cultivated but are now in permanent pasture or hay. This soil is poorly suited to cultivated crops. Crops that require tillage should be grown only to reestablish grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a very severe hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and grassed waterways help prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slope of this soil is moderately steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass IVe.

163E3—Fayette silty clay loam, 14 to 18 percent slopes, severely eroded. This moderately steep, well drained soil is on short, convex slopes that have been dissected by gullies and waterways. Individual areas range from 5 to 65 acres and are elongated and irregular in shape.

Typically, the surface layer is mixed brown and dark yellowish brown silty clay loam about 7 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

This Fayette soil is moderately permeable, and surface runoff is rapid. Available water capacity is high. The content of organic matter is less than 0.5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in poor tilth and becomes cloddy if worked when wet. Intense rainfall causes this soil to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated or have been cultivated. This soil is not suited to cultivated crops because of the hazard of severe erosion.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces erosion. Because the slope of this soil is moderately steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass VIe.

163F—Fayette silt loam, 18 to 25 percent slopes. This steep, well drained soil is on short, convex side slopes. Individual areas range from 5 to 120 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark gray silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 5 inches thick. The subsoil is about 28 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

Included with this soil in mapping are small areas where limestone crops out. These areas make up 5 to 10 percent of the unit.

This Fayette soil is moderately permeable, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction typically is slightly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are in permanent pasture or trees. This soil is not suited to cultivated crops because of the hazard of severe erosion. It is only moderately suited to hay.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slope of this soil is steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass VIe.

163F2—Fayette silt loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on short, convex side slopes. Individual areas range from 10 to 160 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. Some brown subsoil material is mixed with the surface layer. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the surface layer is severely eroded, and these areas have less content of organic matter and are less fertile.

Included with this soil in mapping are small areas where limestone crops out. These areas make up 5 to 10 percent of the unit.

This Fayette soil is moderately permeable, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are in permanent pasture, but some areas are cultivated. This soil is not suited to cultivated crops because the hazard of erosion is severe. Crops that require tillage should be grown only to reestablish grasses for hay and pasture.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slope of this soil is steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass VIe.

163G—Fayette silt loam, 25 to 40 percent slopes. This very steep, well drained soil is on short, convex side slopes. Individual areas range from 15 to 100 acres and are elongated and irregular in shape.

Typically, the surface layer is very dark gray silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 4 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

Included with this soil in mapping are some areas of severely eroded soils that have less content of organic matter and are less fertile than this Fayette soil. Also

included are small areas where limestone crops out. These areas make up 5 to 10 percent of the unit.

This Fayette soil is moderately permeable, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is high in available phosphorus and very low in available potassium. This soil is in good tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are in permanent pasture or trees. This soil is not suited to cultivated crops or hay. It is too steep for the use of ordinary farm machinery. The soil is poorly suited to permanent pasture.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour reduces erosion. Because the slope of this soil is very steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation.

This soil is in capability subclass VIIe.

165—Stronghurst silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad upland divides. Individual areas range from 5 to 40 acres and are irregular in shape.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsurface layer is pale brown silt loam about 5 inches thick. The subsoil is about 34 inches thick. The upper part is grayish brown, friable silty clay loam, the middle part is brown, firm silty clay loam that has strong brown and yellowish brown mottles, and the lower part is light brownish gray, friable silty clay loam that has strong brown and yellowish brown mottles. The substratum to a depth of about 60 inches is light brownish gray and yellowish brown, friable silt loam.

This Stronghurst soil is moderately permeable, and surface runoff is slow. This soil has a seasonal high water table, which occurs most commonly in spring. Available water capacity is high. The content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil generally is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In periods of more than normal rainfall, the installation of tile drainage improves the timeliness of field operations. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIw.

171B—Bassett loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is in slightly convex positions on ridge crests and side slopes in uplands. Individual areas range from 2 to 70 acres and are irregular in shape.

Typically, the surface layer is very dark gray and very dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 2 inches thick. The subsoil is about 42 inches thick. The upper part is brown, friable loam, the middle part is yellowish brown, friable to firm loam, and the lower part is yellowish brown, firm loam that has grayish brown and brown mottles. The substratum to a depth of about 60 inches is yellowish brown, firm loam that has brown and grayish brown mottles.

This Bassett soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from strongly acid to slightly acid as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Erosion and inadequate drainage, which are the major limitations, are difficult to control. The uniform slopes are well suited to contour cultivation and terracing, but these practices slow the movement of surface water and permit more water to soak into the soil. The additional water further complicates the problem of slow drainage, especially in wet years. A combination of terraces and the installation of a tiling system may be needed. If the soil is terraced, exposure of the subsoil should be kept to a minimum

because the subsoil has low fertility and is unfavorable to the operation of tillage equipment. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability subclass IIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes in uplands. Individual areas range from 5 to 70 acres and are irregular in shape.

Typically, the surface layer is very dark gray and brown loam about 7 inches thick. Some brown subsoil material is mixed with the surface layer. The subsoil is 36 inches thick. The upper part is brown, friable loam, the middle part is yellowish brown, friable to firm loam, and the lower part is yellowish brown, firm loam that has grayish brown and brown mottles. The substratum to a depth of about 60 inches is yellowish brown firm loam that has brown and grayish brown mottles.

Included with this soil in mapping are small areas of sandy soil. These areas make up 5 to 10 percent of the unit.

This Bassett soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to slightly acid as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Erosion and inadequate drainage, which are the major limitations, are difficult to control. The slopes are well suited to contour cultivation and terracing (fig. 11), but these practices slow the movement of surface water and permit more water to soak into the soil. The additional water further complicates the problem of slow drainage, especially in wet years. A combination of terraces and the installation of a tile drainage system may be needed. If the soil is terraced, the exposure of the underlying glacial till should be kept to a minimum because the exposed material has low fertility and is unfavorable to the operation of tillage equipment. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability subclass IIIe.

171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on short, convex side slopes in uplands. Individual areas range from 5 to 40 acres and are irregular in shape.

Typically, the surface layer is very dark gray and brown loam about 7 inches thick. Some brown loam subsoil material is mixed with the surface layer. The subsoil is 34 inches thick. The upper part is brown, friable loam, the middle part is yellowish brown, friable to firm loam, and the lower part is yellowish brown, firm loam that has grayish brown and brown mottles. The substratum to a depth of about 60 inches is yellowish brown, firm loam that has brown and grayish brown mottles. In places the surface layer has more content of organic matter.

Included with this soil in mapping are small areas of sandy soil. Also included are small areas where limestone crops out. These areas make up 10 to 15 percent of the unit.

This Bassett soil is moderately permeable, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to slightly acid as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Erosion and inadequate drainage, which are the major limitations, are difficult to control. The slopes are suited to contour cultivation and terracing, but these practices slow the movement of surface water and permit more water to soak into the

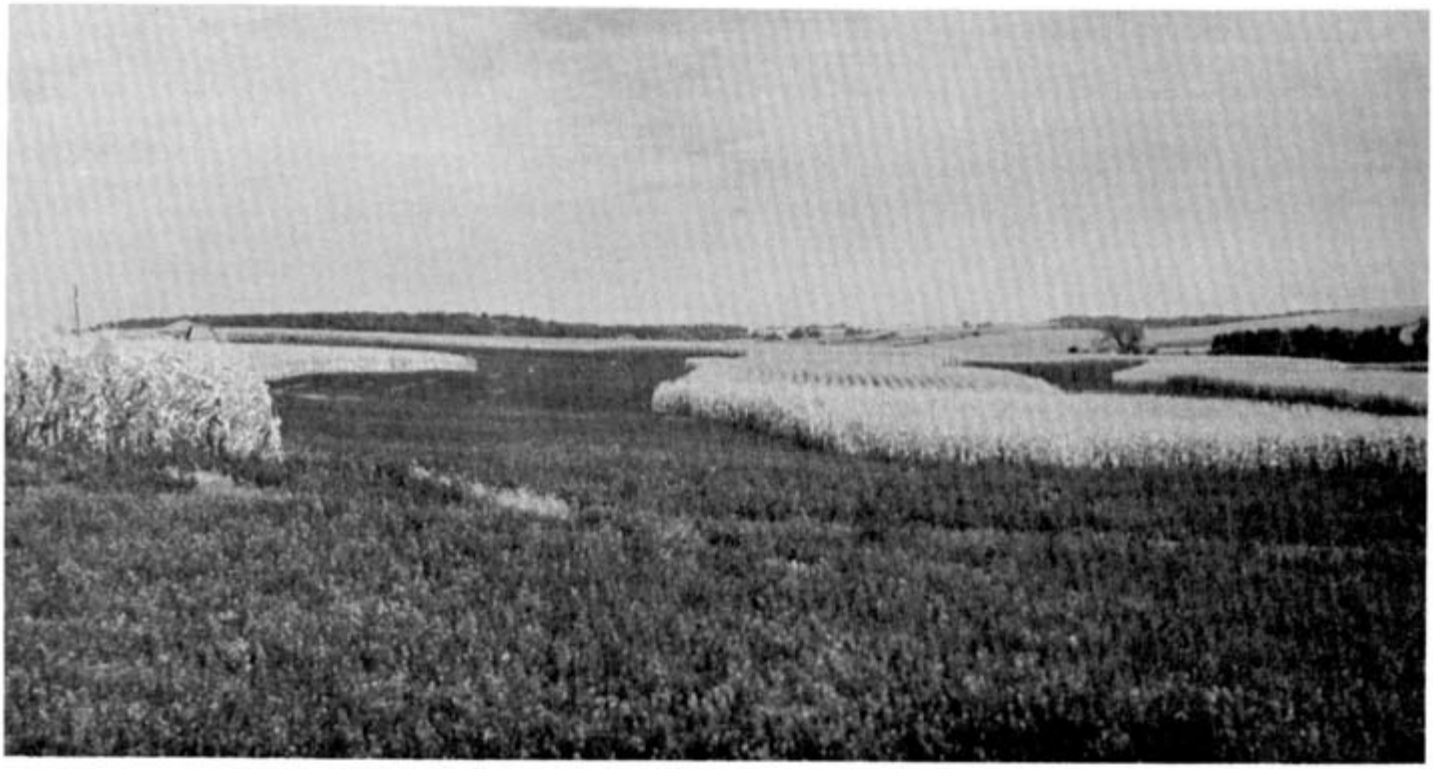

Figure 11.—Contour stripcropping on Bassett loam, 5 to 9 percent slopes, moderately eroded, helps control erosion on sloping soils.

soil. The additional water further complicates the problem of slow drainage, especially in wet years. A combination of terraces and the installation of a tile drainage system may be needed. If the soil is terraced, exposure of the underlying glacial till should be kept to a minimum because the exposed material has low fertility and is unfavorable to the operation of tillage equipment. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability subclass IIIe.

171D3—Bassett loam, 9 to 14 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on short, convex side slopes in uplands. Individual areas range from 5 to 25 acres and are irregular in shape.

Typically, the surface layer is mixed, brown and yellowish brown loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is brown loam, the middle part is yellowish brown, friable to firm loam, and the lower part is yellowish brown, firm loam that has grayish brown and brown mottles. The substratum to a depth of about 60 inches is yellowish brown, firm loam that has brown and grayish brown mottles.

Included with this soil in mapping are small areas of sand or gravel. These areas make up 5 to 10 percent of the unit.

This Bassett soil is moderately permeable, and surface runoff is medium to rapid. Available water capacity is high. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from strongly acid to slightly acid as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in poor tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop

residue on the surface throughout the year, helps prevent excessive soil loss. Erosion and inadequate drainage, which are the major limitations, are difficult to control. The slopes are suited to contour cultivation and terracing, but these practices slow the movement of surface water and permit more water to soak into the soil. The additional water further complicates the problem of slow drainage, especially in wet years. A combination of terraces and the installation of a tile drainage system may be needed. If the soil is terraced, the exposure of the underlying glacial till should be kept to a minimum because the exposed material has low fertility and is unfavorable to the operation of tillage equipment. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Hardwood seedlings require a site of better quality than conifers and grow more satisfactorily if planted on uncultivated soils. Conifers are better suited to eroded or formerly cultivated soils. If areas of this soil are planted to trees, competing vegetation needs to be controlled by careful site preparation or by spraying or cutting.

This soil is in capability subclass IVe.

173—Hoopeston fine sandy loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on benches along streams and in uplands. Individual areas range from 5 acres to 100 acres or more and are elongated and irregular in shape.

Typically, the surface layer is very dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 24 inches thick. It is dark grayish brown sandy loam that has dark brown mottles in the lower part. The substratum to a depth of about 60 inches is mottled light brownish gray, pale brown, and dark brown loamy sand.

Permeability is moderately rapid in the upper part of this Hoopeston soil and rapid in the lower part. Surface runoff is slow. This soil has a seasonal high water table. Available water capacity is moderate. The content of organic matter is about 2 to 3 percent in the surface layer. Reaction ranges from strongly acid to slightly acid as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Droughtiness may be a hazard during seasons of less than normal rainfall. This soil has a seasonal high water table in spring, but during the growing season the water table drops rapidly. In some areas artificial drainage is beneficial during the wet seasons; however, the installation of tile may be difficult because of the loose, water bearing sand. If this soil is used for cultivated crops, soil blowing is a hazard. Newly seeded crops on this soil and adjacent soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet or dry, however, reduces the vegetative cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during adverse moisture conditions help keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

174B—Bolan loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on knolls and convex ridgetops in uplands and on stream benches. Individual areas range from 2 to 30 acres and are narrow and irregular in shape.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 13 inches thick. The subsoil is about 16 inches thick. The upper part is brown, friable loam, and the lower part is brown and yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown, loose sand.

This Bolan soil is moderately permeable in the surface layer and subsoil and rapidly permeable in the substratum. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a slight hazard if the soil is used for cultivated crops. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and grassed waterways help prevent excessive soil loss. In most places, contouring is beneficial. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition. The carrying capacity of the pasture is slightly reduced during dry periods because of the droughtiness of this soil.

This soil is in capability subclass IIe.

175—Dickinson fine sandy loam, 0 to 2 percent slopes. This nearly level, well drained to somewhat excessively drained soil is on ridges and level areas in uplands and on stream benches. Individual areas range from 2 to 15 acres and are irregular in shape.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 20 inches thick. The upper part is very dark grayish brown and dark brown, very friable sandy loam, the middle part is brown to dark yellowish brown, very friable fine sandy loam, and the lower part is yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Permeability is moderately rapid in the upper part of this Dickinson soil and rapid in the lower part. Surface runoff is slow, and available water capacity is moderate. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but a few areas are in permanent pasture and hay. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture but tends to be droughty in most years. If this soil is used for cultivated crops, soil blowing is a hazard. Newly seeded crops on this soil and adjacent soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained or somewhat excessively drained soil is on ridges and side slopes in uplands and on stream benches. Individual areas range from 2 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown, friable to very friable fine sandy loam about 9 inches thick. The subsoil is about 20 inches thick. The upper part is very dark grayish brown and dark brown, very friable fine sandy loam, the middle part is brown to dark yellowish brown, very friable fine sandy loam, and the lower part is yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In places in small areas of soil in the uplands, glacial till is at a depth of 36 to 48 inches.

Permeability is moderately rapid in the upper part of this Dickinson soil and rapid in the lower part. Surface runoff is slow to medium, and available water capacity is moderate. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but a few areas are used for hay and permanent pasture. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture, but it is droughty in some years. If this soil is used for cultivated crops, erosion and soil blowing are hazards. Newly seeded crops on this soil and adjacent soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil loss. In most places contouring and terracing are beneficial. However, terraces may be difficult to construct and maintain because the soil is unstable. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

175C—Dickinson fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained or somewhat excessively drained soil is in convex positions on ridges and side slopes in uplands and on stream benches. Individual areas range from 2 to 25 acres and are irregular in shape.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown to very dark grayish brown, friable to

very friable fine sandy loam about 6 inches thick. The subsoil is about 16 inches thick. The upper part is very dark grayish brown and dark brown, very friable sandy loam, the middle part is brown to dark yellowish brown, very friable fine sandy loam, and the lower part is yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In places in small areas of soil in the uplands glacial till is at a depth of 36 to 48 inches.

Permeability is moderately rapid in the upper part of this Dickinson soil and rapid in the lower part. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in good tilth.

Most areas of this soil are cultivated, but some areas are used for hay or permanent pasture. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture but tends to be droughty. If this soil is used for cultivated crops, erosion and soil blowing are hazards. Newly seeded crops on this soil and adjacent soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent soil loss. In most places contouring and terracing are beneficial; however, terraces are difficult to construct and maintain because the soil is unstable. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

178—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil is mainly on stream benches, but a few areas are in uplands. Individual areas range from 2 to 40 acres and are irregular in shape.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 12 inches thick. The subsoil is about 19 inches thick. The upper part is dark brown, friable loam, the middle part is brown, friable loam, and the lower part is dark yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand and sand.

This Waukee soil is moderately permeable in the surface layer and subsoil and very rapidly permeable in the substratum. Surface runoff is slow. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture but tends to be slightly droughty in years of less than average rainfall. If this soil is used for cultivated crops, soil blowing is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

179D2—Gara loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained to moderately well drained soil is on side slopes in uplands adjacent to drainageways. Individual areas typically range from 5 acres to more than 100 acres and are long and irregular in shape.

Typically, the surface layer is mixed with the subsurface layer and upper part of the subsoil by plowing. It is very dark grayish brown and dark yellowish brown loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is dark yellowish brown, friable loam and firm clay loam, and the lower part is yellowish brown, firm clay loam that has grayish brown mottles in the lower part. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam that has a few grayish brown mottles. In places the surface layer is higher in content of organic matter.

Included with this soil in mapping are small areas of Armstrong soils along the tops of the slopes. These areas are higher in content of clay and lower in content of organic matter than this Gara soil. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Gara soil, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low to very low in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is moderately suited to occasional row crops in rotation with small grains and grasses and legumes for hay and

pasture, but it is better suited to hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a moderate hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees. Hardwood seedlings require a good site and grow better if planted on uncultivated soils. Seedlings should survive well if adapted species are selected and managed properly.

This soil is in capability subclass IVe.

179E2—Gara loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained to moderately well drained soil is on side slopes in uplands adjacent to drainageways. Individual areas typically range from about 5 acres to more than 30 acres and are long and irregular in shape.

Typically, the surface layer is mixed with the subsurface layer and a small amount of subsoil material. It is very dark grayish brown and dark yellowish brown loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is dark yellowish brown, friable loam and firm clay loam, and the lower part is yellowish brown, firm clay loam that has grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam that has grayish brown mottles. In places the surface layer is slightly eroded and is higher in content of organic matter.

Included with this soil in mapping are small areas of Armstrong soils along the tops of the slopes. These areas are higher in content of clay and lower in content of organic matter than this Gara soil. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Gara soil, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low to low in available phosphorus and low in available potassium. This soil is in fair tilth.

Most areas of this soil are in permanent pasture or trees. This soil is not suited to cultivated row crops. It is better suited to hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a severe hazard.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, but very few areas remain in native hardwoods. Careful consideration should be given to the location of trails or roads used in logging on this soil so that the possibility of erosion can be reduced. For example, laying out trails or roads on the contour or nearly on the contour helps reduce soil erosion. Because the slope of this soil is steep, the operation of equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation. The survival of seedlings and competition from undesirable plants are concerns in management.

This soil is in capability subclass VIe.

184—Klinger silty clay loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on flat, broad divides, in concave positions at the heads of drainageways, and on side slopes. Individual areas range from 2 to 70 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black or very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, friable silty clay loam, the middle part is grayish brown, friable silty clay loam that has yellowish brown mottles, and the lower part is mottled yellowish brown and grayish brown, firm loam. In places a stone line is at the boundary between the silty clay loam and the loam. Sand lenses are common at this junction of silty clay loam and loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown, firm loam. In places the surface layer contains more sand.

This Klinger soil is moderately permeable, and surface runoff is slow to medium. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 6 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Although not all areas of the soil are in need of tile drainage, crops are benefited and earlier field operations are possible if tile is installed to lower the seasonal high water table. On gently sloping areas, a combination of erosion control measures and tile drainage is advisable if row crops are grown intensively. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction,

increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

220—Nodaway silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains, in narrow upland drainageways, or on alluvial fans. This soil is subject to flooding. Individual areas range from 10 to 120 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown and dark grayish brown silt loam about 6 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, dark grayish brown, and grayish brown, stratified, friable silt loam. In places the dark buried soil is at a depth of less than 40 inches. In other places sandy material is at a depth of more than 40 inches.

This Nodaway soil is moderately permeable, and surface runoff is slow. It has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. Reaction typically is slightly acid to neutral throughout. The subsoil is medium in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. Areas that are inaccessible or are in narrow drainageways generally are in permanent pasture or woodland. This soil is well suited to corn, soybeans, and small grains and suited to grasses and legumes for hay and pasture. During periods of heavy rain this soil is subject to overflow, and crops are damaged in some years. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees, and a few areas remain in native hardwoods. Natural or planted seedlings outside the flood pool of Coralville Reservoir survive and grow well if competing vegetation is removed during site preparation or controlled by spraying, cutting, or girdling. Other limitations or hazards in the planting or harvesting of trees are slight.

This soil is in capability subclass IIw.

226—Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches and outwash plains. Individual areas range from 5 to 80 acres and are irregular in shape.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black to very dark grayish brown loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown, friable loam that has a few strong brown mottles, and the lower part is grayish brown, friable loam that has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is grayish brown sand that has strong brown mottles. In places coarse material is at a depth of 24 to 32 inches.

This Lawler soil is moderately permeable in the surface layer and subsoil and very rapidly permeable in the underlying coarse textured material. Surface runoff is slow. This soil has a seasonal high water table. Available water capacity is moderate. The content of organic matter is about 4 to 5 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated and used intensively for row crops. This soil is well suited to corn, soybeans, hay, and pasture. If the soil is used for cultivated crops, soil blowing is a slight hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. This soil has a fluctuating water table that drops during the growing season. In some areas tile drainage may be beneficial during the wet seasons; however, the installation of a tile drainage system may be difficult because of the loose, water-bearing sand and gravel. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIs.

279—Taintor silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in slightly depressional areas on broad upland flats. Individual areas range from 5 to 40 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black to very dark gray silty clay loam about 10 inches thick. The subsoil is about 48 inches thick. The upper part is very dark gray, firm silty clay, the middle part is grayish brown and olive gray, firm silty clay, and the lower part is olive gray and light olive gray, friable silty clay loam. The substratum to a depth of about 60 inches is olive gray and light olive gray, friable silt loam. Yellowish brown and

strong brown mottles are throughout the subsoil and substratum.

Permeability is moderately slow in this Taintor soil. Surface runoff is slow, and the soil is subject to ponding in low spots for short periods. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 4 to 6 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth. It puddles readily if worked when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Tile drainage is needed for maximum production. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

280—Mahaska silty clay loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad upland divides. Individual areas range from 5 to 100 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black to very dark gray silty clay loam about 14 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, friable silty clay loam, and the middle and lower parts are grayish brown and olive gray, firm silty clay loam that has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is light olive gray, friable silt loam that has yellowish brown and strong brown mottles.

Included with this soil in mapping are small areas of poorly drained Taintor soils in slightly depressed areas. These areas make up 5 to 10 percent of the unit.

This Mahaska soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 6 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. The installation of a tile drainage system may benefit field operations in years of more than normal rainfall. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

281B—Otley silty clay loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is in convex positions on ridgetops and side slopes in uplands. Individual areas range from 5 to 100 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark brown to very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 28 inches thick. The upper part is brown, firm silty clay loam, the middle part is yellowish brown, firm silty clay loam that has grayish brown mottles, and the lower part is mottled yellowish brown, grayish brown, and strong brown, firm silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has strong brown mottles.

This Otley soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but some areas are in permanent pasture and hay. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In most areas contouring and terracing are well suited because slopes are uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

281C2—Otley silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on convex side slopes in uplands. Individual areas range from 5 to 100 acres and are elongated and irregular in shape.

Typically, the surface layer is black, very dark brown, or very dark gray silty clay loam about 8 inches thick. Some brown silty clay loam subsoil material is mixed with the surface layer. The subsoil is about 24 inches thick. The upper part is brown, firm silty clay loam, the middle part is yellowish brown, firm silty clay loam that has grayish brown mottles, and the lower part is mottled yellowish brown, grayish brown, and strong brown, firm silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has strong brown mottles. In places the surface layer is only slightly eroded and has higher content of organic matter.

This Otley soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated, but a few areas are used for pasture and hay. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In most areas contouring and terracing are well suited because slopes are uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and the soil in good condition.

This soil is in capability subclass IIIe.

281D2—Otley silty clay loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes. Individual areas range from 5 to 40 acres and are elongated and irregular in shape.

Typically, the surface layer is black, very dark brown, or very dark gray silty clay loam about 8 inches thick. Some brown silty clay loam subsoil material is mixed with the surface layer. The subsoil is about 22 inches thick. The upper part is brown, firm silty clay loam, the middle part is yellowish brown, firm silty clay loam that has grayish brown mottles, and the lower part is mottled yellowish brown, grayish brown, and strong brown, firm light silty clay loam. The substratum to a depth of about 60 inches is light brownish gray silt loam that has strong brown mottles. In places the surface layer is only slightly eroded and has a higher content of organic matter.

This Otley soil is moderately permeable, and surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 2.5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. This soil is in fair tilth. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retarded plant growth.

Most areas of this soil are cultivated, but a few areas are used for pasture or hay. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In most areas contouring and terracing are well suited because slopes are uniform. If terraced, this soil can be planted to row crops more often in the rotation. Returning crop residue or the regular addition of other organic material helps improve fertility and tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

284—Flagler sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on stream benches. It is subject to seasonal flooding. Individual areas range from 10 to 40 acres and are irregular in shape.

Typically, the surface layer is black or very dark grayish brown sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown sandy loam about 13 inches thick. The subsoil is dark yellowish brown sandy loam about 17 inches thick. The substratum to a depth of about 60 inches is stratified, yellowish brown and dark brown loamy sand and gravel.

Permeability is moderately rapid in the surface layer and subsoil of this Flagler soil and very rapid in the substratum. Surface runoff is slow, and available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming

practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is poorly suited to row crops, such as corn and soybeans, but it is moderately well suited to small grains and grasses and legumes for hay and pasture. Droughtiness is a hazard in most years unless rainfall is timely. If this soil is cultivated, soil blowing is a hazard. Newly seeded crops on this soil and adjacent soils are sometimes damaged by blowing sand if not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay tends to increase the biological activity of this soil. Overgrazing, however, reduces the protective vegetative cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIs.

285C—Burkhardt sandy loam, 5 to 9 percent slopes. This moderately sloping, somewhat excessively drained soil is on stream benches and in convex positions on high knolls and side slopes in uplands. Individual areas range from 10 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark brown sandy loam about 6 inches thick. The subsurface layer is very dark brown and very dark grayish brown sandy loam about 7 inches thick. The subsoil is dark brown, very friable sandy loam about 7 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown, loose sand that is about 20 percent gravel.

This Burkhardt soil is rapidly permeable, and surface runoff is medium. Available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from strongly acid to slightly acid as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth.

Most areas of this soil are used for hay and pasture. This soil is poorly suited to row crops such as corn and soybeans, but it is moderately suited to small grains and to grasses and legumes for hay and pasture. Droughtiness is a hazard in most years unless rainfall is timely. If this soil is cultivated, soil blowing is a hazard. Newly seeded crops on this soil and adjacent soils are sometimes damaged by blowing sand if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and prevent soil blowing.

The use of this soil for pasture and hay tends to increase the biological activity in the soil and lessen soil blowing. Overgrazing, however, reduces the protective vegetative cover and causes deterioration of the plant community. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees. Planted seedlings do not survive well because the soil is droughty; therefore, the seedlings should be planted close together and thinned later to achieve the desired stand density. Supplemental water may be needed. Competing vegetation needs to be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IVs.

291—Atterberry silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on divides, at the heads of drainageways, and at the base of slopes in uplands. Individual areas range from 5 to 40 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam, the middle part is grayish brown and gray, friable silty clay loam that has yellowish brown mottles, and the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has yellowish brown mottles.

Included with this soil in mapping are small areas of nearly level Walford soils that are more poorly drained. These areas are in slight depressions and make up 5 to 10 percent of the unit.

This Atterberry soil is moderately permeable, and surface runoff is slow. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 4 percent, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil; however, heavy rainfall causes this soil to puddle readily if worked when wet.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The soil has a seasonal high water table, especially in spring. The installation of a tile drainage system improves the timeliness of field operations in years of more than normal rainfall. Because the Atterberry soil at the base

of slopes receives runoff and seepage from the soils upslope, tile drainage generally is needed to obtain satisfactory yields. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability class I.

291B—Atterberry silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is at the heads of drainageways and at the base of slopes in uplands. Individual areas range from 5 to 30 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. Part of the platy subsurface layer has been mixed into the surface layer in plowing. The subsoil is about 36 inches thick. The upper part is brown, friable silty clay loam, the middle part is grayish brown and gray, friable silty clay loam that has yellowish brown mottles, and the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has yellowish brown mottles.

This Atterberry soil is moderately permeable, and surface runoff is slow to medium. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil; however, heavy rainfall causes this soil to puddle readily if worked when wet.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In most places contouring and terracing are beneficial. Because this soil receives runoff and seepage from the soils upslope, tile drainage generally is needed to remove excess water and to permit timely field operations. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability subclass IIe.

293C—Chelsea-Lamont-Fayette complex, 5 to 9 percent slopes. These moderately sloping, well drained and excessively drained soils are on ridgetops and side slopes in uplands. Individual areas range from 10 to 15 acres and are irregular in shape. This map unit is about 45 percent Chelsea soils, 35 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is very dark gray and very dark grayish brown loamy fine sand about 5 inches thick. It is underlain by a subsurface layer of dark grayish brown, brown, and yellowish brown, loose fine sand about 36 inches thick. Below that to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam. In cultivated areas the surface layer is dark grayish brown to dark brown loamy fine sand about 7 inches thick.

Typically, the surface layer of the well drained Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is 23 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin bands of brown loamy sand.

Typically, the surface layer of the well drained Fayette soil is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 7 inches thick. The subsoil is 35 inches thick. The upper part is dark brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In cultivated areas the surface layer is dark grayish brown silt loam about 7 inches thick. In places the surface layer is mixed with the subsoil.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on these soils is medium. Available water capacity is low in the Chelsea soil, moderate in the

Lamont soil, and high in the Fayette soil. The content of organic matter is about 0.5 to 2 percent in the surface layers, and reaction ranges from slightly acid to strongly acid in uncultivated areas. In cultivated areas reaction ranges from strongly acid to neutral as a result of local liming practices. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont subsoil is medium in available phosphorus and very low in available potassium, and the Fayette soil is high in available phosphorus and very low in available potassium.

Many areas of this map unit are in pasture or trees, but a few areas are cultivated. These soils are poorly suited to corn, soybeans, and small grains because they are droughty and low in fertility. They are better suited to grasses and legumes for hay and pasture. If the soils are used for cultivated crops, erosion is a hazard. In addition, soil blowing is a hazard on the Chelsea and Lamont soils. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In some places contouring and terracing are beneficial. Terraces are suitable in a few areas where the Fayette soil is predominant, but the topography generally is not uniform and the construction of terraces is difficult. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees. Planted seedlings survive and grow well on the Lamont and Fayette soils. They do not survive well on the Chelsea soil because of low available moisture. On the Chelsea soil seedlings should be planted close together and thinned later to achieve the desired stand density. On all of the soils competing vegetation needs to be controlled or removed by careful site preparation or by spraying.

These soils are in capability subclass IIIe.

293C2—Chelsea-Lamont-Fayette complex, 5 to 9 percent slopes, moderately eroded. These moderately sloping, well drained and excessively drained soils are on ridgetops and side slopes in uplands. Individual areas range from 15 to 30 acres and are irregular in shape. This map unit is about 45 percent Chelsea soils, 35 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is dark grayish brown to brown loamy fine sand about 7 inches thick. It is underlain by a subsurface layer of brown and yellowish brown, loose fine sand about 38 inches thick. Below that to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the surface of the well drained Lamont soils is dark grayish brown fine sandy loam about 7 inches thick. Some dark yellowish brown subsoil is mixed with the surface layer. The subsoil is 23 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose sand that has thin bands of brown loamy sand.

Typically, the surface layer of the well drained Fayette soil is dark grayish brown and brown silt loam and silty clay loam about 7 inches thick. Some subsoil is mixed with the surface layer. The subsoil is about 32 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on these soils is medium. Available water capacity is low in the Chelsea soil, moderate in the Lamont soil, and high in the Fayette soil. The content of organic matter is about 0.5 to 1 percent in the surface layers. In uncultivated areas reaction ranges from slightly acid to strongly acid, and in cultivated areas it ranges from strongly acid to neutral as a result of local liming practices. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont soil is medium in available phosphorus and very low in available potassium, and the Fayette soil is high in available phosphorus and very low in available potassium.

Most areas of this map unit are cultivated, but a few areas are in pasture or trees. These soils are poorly suited to corn, soybeans, and small grains because they are droughty and low in fertility. Crop yields and pasture carrying capacity depend on the amount and timeliness of rainfall. If the soils are used for cultivated crops, erosion is a hazard. In addition, soil blowing is a hazard on the Chelsea and Lamont soils. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In places contouring and terracing are beneficial. Terraces are suitable in a few areas where the Fayette soil is predominant, but the topography generally is not uniform and the construction of terraces is difficult. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation,

timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees. Planted seedlings survive and grow well on the Lamont and Fayette soils. They do not survive well on the Chelsea soil because of low available moisture. On the Chelsea soil seedlings should be planted close together and thinned later to achieve the desired stand density. On all of the soils competing vegetation needs to be controlled or removed by careful site preparation or by spraying.

These soils are in capability subclass IIIe.

293D—Chelsea-Lamont-Fayette complex, 9 to 14 percent slopes. These strongly sloping, well drained and excessively drained soils are on ridgetops and side slopes in uplands. Individual areas range from 10 to 20 acres and are irregular in shape. This map unit is about 45 percent Chelsea soils, 35 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. It is underlain by a subsurface layer of dark grayish brown, brown, and yellowish brown, loose fine sand about 38 inches thick. Below that to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the surface layer of the well drained Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 20 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose sand that has thin bands of brown loamy sand.

Typically, the surface layer of the well drained Fayette soil is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 6 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In cultivated areas part or all of the original subsurface layer is mixed with the surface layer. In places the surface layer is mixed with the subsoil.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on these soils is medium. Available water capacity is low in the Chelsea soil, moderate in the Lamont soil, and high in the Fayette soil. The content of organic matter is about 0.5 to 2 percent in the surface layers. In uncultivated areas reaction ranges from slightly acid to strongly acid, and in cultivated areas it ranges from strongly acid to neutral as a result of local liming practices. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont subsoil is medium in available phosphorus and very low in available potassium, and the Fayette subsoil is high in available phosphorus and very low in available potassium.

Most areas of this map unit are in permanent pasture or trees, but a few areas are cultivated. These soils are poorly suited to corn, soybeans, and small grains because they are droughty and low in fertility. They are better suited to grasses and legumes for hay and pasture. If the soils are used for cultivated crops, erosion is a hazard. In addition, soil blowing is a hazard on the Chelsea and Lamont soils. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In some places, contouring and terracing are beneficial. Terraces are suitable in a few areas where the Fayette soil is predominant, but the topography generally is not uniform and the construction of terraces is difficult. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees. Planted seedlings survive and grow well on the Lamont and Fayette soils. They do not grow well on the Chelsea soil because of low available moisture. On the Chelsea soil seedlings should be planted close together and thinned later to achieve the desired stand density. On all of these soils competing vegetation needs to be controlled or removed by careful site preparation or by spraying.

These soils are in capability subclass IVe.

293D2—Chelsea-Lamont-Fayette complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping, well drained and excessively drained soils are on ridgetops and side slopes in uplands. Individual areas range from 15 to 30 acres and are irregular in shape. This map unit is about 45 percent Chelsea soils, 35 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is brown loamy fine sand about 7 inches thick. It is underlain by a subsurface layer of brown and yellowish brown, loose fine sand about 35 inches thick. Below that to a depth of 60 inches or more is yellowish

brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the surface layer of the well drained Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. Some dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 20 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose sand that has thin bands of brown loamy sand.

Typically, the surface layer of the well drained Fayette soil is dark grayish brown and brown silt loam about 7 inches thick. Some dark grayish brown and dark yellowish brown silty clay loam subsoil material is mixed with the surface layer. The subsoil is about 30 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on these soils is medium. Available water capacity is low in the Chelsea soil, moderate in the Lamont soil, and high in the Fayette soil. The content of organic matter is about 0.5 to 1 percent in the surface layers. In uncultivated areas reaction ranges from slightly acid to strongly acid, and in cultivated areas it ranges from strongly acid to neutral as a result of local liming practices. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont subsoil is medium in available phosphorus and very low in available potassium, and the Fayette subsoil is high in available phosphorus and very low in available potassium.

Most areas of this map unit are cultivated, but a few areas are in pasture or trees. These soils are poorly suited to corn, soybeans, and small grains because they are droughty and low in fertility. They are better suited to grasses and legumes for hay and pasture. If these soils are used for cultivated crops, erosion is a hazard. In addition, soil blowing is a hazard on the Chelsea and Lamont soils. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In places contouring and terracing are beneficial. Terraces are suitable in a few areas where the Fayette soil is predominant, but the topography generally is not uniform and the construction of terraces is difficult. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees. Planted seedlings survive and grow well on the Lamont and Fayette soils. They do not grow well on the Chelsea soil because of low available moisture. On the Chelsea soil seedlings need to be planted close together and thinned later to achieve the desired stand density. On all of these soils competing vegetation needs to be controlled or removed by site preparation or by spraying.

These soils are in capability subclass IVe.

293E—Chelsea-Lamont-Fayette complex, 14 to 18 percent slopes. These moderately steep, well drained and excessively drained soils are on ridgetops and side slopes in uplands. Individual areas range from 10 to 40 acres and are irregular in shape. This map unit is about 40 percent Chelsea soils, 30 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. It is underlain by a subsurface layer of dark grayish brown and yellowish brown, loose fine sand about 35 inches thick. Below that to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam. In cultivated areas the surface layer is brown loamy fine sand about 7 inches thick.

Typically, the surface layer of the well drained Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 20 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin bands of brown loamy sand.

Typically, the surface layer of the well drained Fayette soil is very dark gray silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 5 inches thick. The subsoil is about 30 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In cultivated areas part or all of the original subsurface layer is mixed into the plow layer.

Included with these soils in mapping near the base of the slopes are small areas that have limestone close to the surface or cropping out on the surface. The included areas make up about 10 percent of the unit.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on all of these soils is medium to rapid. Available water capacity is low in the Chelsea soil, moderate in the Lamont soil, and high in the Fayette soil. The content of organic matter is about 0.5 to 2 percent in the surface layers. In uncultivated areas reaction ranges from slightly acid to strongly acid, and in cultivated areas it ranges from strongly acid to neutral as a result of local liming practices. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont subsoil is medium in available phosphorus and very low in available potassium, and the Fayette soil is high in available phosphorus and very low in available potassium.

Many areas of this map unit are in pasture or trees, but a few areas are cultivated. These soils are not suited to cultivated crops. The Chelsea and Lamont soils are droughty and low in fertility. If these soils are used for cultivated crops, erosion is a severe hazard. In addition, the Chelsea and Lamont soils are subject to soil blowing and should be protected by a plant cover at all times.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slopes of these soils are moderately steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation. Natural and planted seedlings survive and grow well on the Lamont and Fayette soils, but they do not grow well on the Chelsea soil. On the Chelsea soil seedlings should be planted close together and thinned later to achieve the desired stand density. On all of these soils competing vegetation needs to be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

These soils are in capability subclass VIe.

293E2—Chelsea-Lamont-Fayette complex, 14 to 18 percent slopes, moderately eroded. These moderately steep, well drained and excessively drained soils are on ridgetops and side slopes in uplands. Individual areas range from 10 to 40 acres and are irregular in shape. This map unit is about 40 percent Chelsea soils, 30 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is brown loamy fine sand about 7 inches thick. It is underlain by a subsurface layer of brown and yellowish brown, loose fine sand about 32 inches thick. Below that to a depth of 60 inches or more is yellowish brown fine sand that has 1-inch bands of brown sandy loam.

Typically, the surface layer of the well drained Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. Some dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 18 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin bands of brown loamy sand.

Typically, the surface layer of the well drained Fayette soil is dark grayish brown and brown silt loam about 7 inches thick. Some brown and dark yellowish brown silty clay loam subsoil material is mixed with the surface layer. The subsoil is about 28 inches thick. The upper and middle parts are brown and dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the surface layer is severely eroded and is brown and yellowish brown silty clay loam.

Included with these soils in mapping are small areas near the base of slopes. These areas have limestone close to the surface or cropping out on the surface. They make up about 10 percent of the map unit.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on all of these soils is medium to rapid. Available water capacity is low in the Chelsea soil, moderate in the Lamont soil, and high in the Fayette soil. The content of organic matter is about 0.5 to 1 percent in the surface layer. In uncultivated areas reaction ranges from slightly acid to strongly acid, and in cultivated areas it ranges from strongly acid to neutral as a result of local liming practices. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont soil is medium in available phosphorus and very low in available potassium, and the Fayette subsoil is high in available phosphorus and very low in available potassium.

Most areas of this map unit are in pasture or trees, but a few areas are cultivated. These soils are not suited to cultivated crops because they are droughty and low in fertility. If the soils are used for cultivated crops, erosion is a severe hazard. In addition, the Chelsea and Lamont soils are subject to soil blowing and should be protected by a plant cover at all times.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes

surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of the trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slopes of these soils are moderately steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation. Natural and planted seedlings survive and grow well on the Lamont and Fayette soils, but they do not grow well on the Chelsea soil. On the Chelsea soil seedlings should be planted close together and thinned later to achieve the desired stand density. On all of the soils competing vegetation needs to be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

These soils are in capability subclass VIe.

293F—Chelsea-Lamont-Fayette complex, 18 to 25 percent slopes. These steep, well drained and excessively drained soils are on side slopes in uplands. Individual areas range from 20 to 35 acres and are irregular in shape. This map unit is about 35 percent Chelsea soils, 30 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. It is underlain by a subsurface layer of dark grayish brown, brown, and yellowish brown, loose fine sand about 32 inches thick. Below that layer to a depth of 60 inches of more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the surface layer of the well drained Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 18 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin bands of brown loamy sand.

Typically, the surface layer of the well drained Fayette soil is very dark gray silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown, friable silt loam about 5 inches thick. The subsoil is about 28 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the surface layer is mixed with subsoil material.

Included with these soils in mapping are small areas near the base of the slopes. These areas have limestone near the surface or cropping out on the surface. They make up about 15 percent of the map unit.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on all of these soils is rapid. Available water capacity is low in the Chelsea soil, moderate in the Lamont soil, and high in the Fayette soil. The content of organic matter is about 0.5 to 2 percent in the surface layer of these soils. Reaction ranges from strongly acid to neutral. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont subsoil is medium in available phosphorus and very low in available potassium, and the Fayette subsoil is high in available phosphorus and very low in potassium.

Most areas of this map unit are in pasture or trees, but a few areas are cultivated. These soils are not suited to cultivated crops because they are steep, droughty, and low in fertility. They are moderately suited to poorly suited to permanent pasture. If these soils are used for cultivated crops, erosion is a severe hazard. The Chelsea and Lamont soils are subject to soil blowing and should be protected by a plant cover at all times.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition. Renovation of pastures is difficult because slopes are steep.

These soils are moderately suited to trees, and a few small areas remain in native hardwoods. Trees grow best on north- and east-facing, lower slopes and in coves. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour reduces erosion. Because the slopes of these soils are steep, some hazard is involved in the operation of farm equipment. Special equipment can be used, but caution is needed in its operation. Natural and planted seedlings survive and grow well on the Lamont and Fayette soils, but they do not grow well on the Chelsea soil. On the Chelsea soil, seedlings should be planted close together and thinned later to achieve the desired stand density. On all of these soils competing vegetation needs to be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

These soils are in capability subclass VIIe.

293G—Chelsea-Lamont-Fayette complex, 25 to 40 percent slopes. These very steep, well drained and

excessively drained soils are on side slopes in uplands. Individual areas range from 20 to 35 acres and are irregular in shape. This map unit is about 35 percent Chelsea soils, 30 percent Lamont soils, and 20 percent Fayette soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the excessively drained Chelsea soil is very dark gray and very dark grayish brown loamy fine sand about 3 inches thick. It is underlain by a subsurface layer of dark grayish brown, very dark grayish brown, brown, and yellowish brown, loose fine sand to a depth of about 29 inches. Below that layer to a depth of 60 inches or more is yellowish brown, loose fine sand that has 1-inch bands of brown sandy loam.

Typically, the surface layer of the well drained Lamont soil is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown and brown fine sandy loam about 3 inches thick. The subsoil is about 18 inches thick. The upper and middle parts are dark yellowish brown, friable fine sandy loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand that has thin bands of brown loamy sand.

Typically, the well drained Fayette soil is very dark gray silt loam about 2 inches thick. The subsurface layer is dark grayish brown and brown, friable silt loam about 4 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam.

Included with these soils in mapping are small areas near the base of the slopes. These areas have limestone near the surface or cropping out on the surface. They make up about 15 percent of the map unit.

Permeability is rapid in the Chelsea soil, moderately rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff on all of these soils is rapid. Available water capacity is low in the Chelsea soil, moderate in the Lamont soil, and high in the Fayette soil. The content of organic matter is 0.5 to 2 percent in the surface layer, and reaction ranges from strongly acid to neutral. The Chelsea subsoil is very low in available phosphorus and potassium, the Lamont subsoil is medium in available phosphorus and very low in available potassium, and the Fayette subsoil is high in available phosphorus and very low in available potassium.

Most areas of these soils are in pasture or trees, but a few areas are cultivated. These soils are not suited to corn, soybeans, small grains, or hay because slopes are very steep. They are moderately well suited to poorly suited to permanent pasture. If these soils are used for cultivated crops, erosion is a severe hazard. In addition, the Chelsea and Lamont soils are subject to soil blowing and should be protected by a plant cover at all times.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the Fayette soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition. Renovation of pastures is difficult because of the very steep slopes.

These soils are moderately suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slopes of these soils are very steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation. Natural and planted seedlings survive and grow well on the Lamont and Fayette soils but do not survive well on the Chelsea soil. On the Chelsea soil seedlings should be planted close together and thinned later to achieve the desired stand density. On all soils competing vegetation needs to be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

These soils are in capability subclass VIIe.

320—Arenzville silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains and in narrow upland drainageways. It is subject to flooding by runoff from adjacent areas. Individual areas range from 5 to 50 acres and are elongated and irregular in shape.

Typically, the surface layer is dark grayish brown silt loam that has thin strata of light yellowish brown and brown silt loam. It is about 11 inches thick. The substratum is about 22 inches thick. It is dark gray, dark grayish brown, and brown, stratified, friable silt loam. Below that is an older buried surface layer. It is black silt loam and silty clay loam about 21 inches thick. The underlying layer to a depth of about 60 inches is very dark gray, friable silty clay loam.

Included with this soil in mapping are small areas of Colo silt loam overwash. They have a shallower silt loam surface layer and tend to be wetter during early seasons of the year than Arenzville soil. These areas make up 5 to 10 percent of the unit.

This Arenzville soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from slightly acid to neutral. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. Areas that are inaccessible or in narrow drainageways generally are in permanent pasture or trees. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is subject to overflow during periods of high rainfall, however, and in some years crops are damaged by water or by recent deposition. The use of properly placed diversion terraces on soils upslope help to protect this soil from local runoff and reduce siltation. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIw.

350B—Waukegan silt loam, 1 to 5 percent slopes. This nearly level to gently sloping, well drained soil is on stream benches and on uplands. Individual areas range from 5 to 25 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is brown and dark yellowish brown, friable silty clay loam about 23 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand and sand. In some places the soil is nearly level.

This Waukegan soil is moderately permeable in the upper part of the subsoil and rapidly permeable in the lower part and substratum. Surface runoff is slow to medium. Available water capacity is moderate. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is somewhat droughty in years of less than normal rainfall. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In some places contouring and terracing are beneficial. If this soil is terraced, cuts should be held to a minimum so that the underlying sand and gravel is not exposed. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

352B—Whittier silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream benches and on uplands. Individual areas range from 3 to 25 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown, friable silt loam about 2 inches thick. The subsoil is about 27 inches thick. The upper part is dark yellowish brown and brown, friable silty clay loam, the middle part is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In places the surface layer is thicker and darker and has more content of organic matter. In other places small areas are silty at a depth of more than 40 inches and have higher available water capacity.

This Whittier soil is moderately permeable in the surface layer and upper part of the subsoil and rapidly permeable in the lower part and substratum. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture but is somewhat droughty in years of less than normal rainfall. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In places contouring and terracing are beneficial. If the soil is terraced, cuts should be held to a minimum so that the underlying sandy material is not exposed. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

352C2—Whittier silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on convex side slopes in uplands. Individual areas range from 2 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. Some dark yellowish brown subsoil material is mixed with the surface layer. The subsoil is about 22 inches thick. The upper part is yellowish brown and brown, friable silty clay loam, the middle part is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In places the surface layer is thicker and has more content of organic matter.

This Whittier soil is moderately permeable in the surface layer and upper part of the subsoil and rapidly permeable in the substratum. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is somewhat droughty in years of less than normal rainfall. If the soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In places contouring and terracing are beneficial. If this soil is terraced, cuts should be kept to a minimum so that the underlying sandy material is not exposed. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

377B—Dinsdale silty clay loam, 2 to 5 percent slopes. This gently sloping, well drained and moderately well drained soil is in slightly convex positions on crests and side slopes in uplands. Individual areas range from 5 to 120 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark brown silty clay loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, brown, and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable loam that has a few light brownish gray mottles at a depth of more than 33 inches. The substratum to a depth of about 60 inches is mottled yellowish brown and light grayish brown, calcareous loam.

This Dinsdale soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In most places contouring and terracing are beneficial. If this soil is terraced, cuts should be kept to a minimum so that the glacial till subsoil, which is lower in fertility than the surface soil, is not exposed. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

377C2—Dinsdale silty clay loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained and moderately well drained soil is on convex side slopes in uplands. Individual areas range from 5 to 25 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. Some dark brown silty clay loam subsoil material is mixed with the surface layer. The subsoil is about 20 inches thick. The upper part is dark brown, brown, and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable loam that has a few light brownish gray mottles at a depth of

more than 33 inches. The substratum to a depth of about 60 inches is mottled yellowish brown and light grayish brown, firm, neutral or calcareous loam. In places the surface layer is thicker and darker and has more organic matter.

This Dinsdale soil is moderately permeable. It is more permeable in the upper part of the subsoil than in the lower part and substratum. Surface runoff is medium, and available water capacity is high. The content of organic matter is about 2.5 to 3 percent in the surface layer. Reaction ranges from strongly acid to neutral in the surface layer as a result of local liming practices but is typically medium acid in the subsoil. The subsoil is low in available phosphorus and very low in available potassium. This soil is in fair tilth.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In most places contouring and terracing are beneficial. If this soil is terraced, cuts should be kept to a minimum so that the glacial till subsoil, which is lower in fertility than the surface soil, is not exposed. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

382—Maxfield silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in slight depressions and shallow drainageways in uplands. Individual areas range from 5 to 100 acres and are irregular or elongated in shape.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black, friable silty clay loam about 6 inches thick. The subsoil is about 25 inches thick. The upper part is olive gray and grayish brown, friable silty clay loam and silt loam that has many yellowish brown mottles, and the lower part is mottled yellowish brown and light brownish gray, firm loam. In places a stone line or sand lenses are at the boundary between the silty clay loam and loam. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray, firm loam. In places small areas of soil have sandy loam or loamy sand lenses in the silty clay loam subsoil. These areas are more than 10 inches thick.

This Maxfield soil is moderately permeable, and surface runoff is slow. This soil is subject to ponding for short periods in low places. It has a seasonal high water table. Available water capacity is high. The content of organic matter is about 6 to 7 percent in the surface layer. Reaction typically is neutral but varies as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Artificial drainage may be needed to lower the seasonal high water table and improve the timeliness of field operations. Areas of this soil that are not adequately drained generally are used for pasture or hay. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

420B—Tama silt loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on loess covered stream benches. Individual areas range from 2 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silt loam about 10 inches thick. The subsoil is about 28 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles. It is underlain by stratified sand at a depth of more than 60 to 96 inches. In places these strata occur at a depth as shallow as 48 inches.

Included with this soil in mapping are a few areas that are moderately sloping, and other areas that are moderately sloping and moderately eroded. These areas are more subject to erosion than the gently sloping Tama soil and have less content of organic matter in the surface layer. Also included are small areas of soil that are nearly level. All of these areas make up 10 to 15 percent of the unit.

This Tama soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil

is low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but some areas are in permanent pasture and hay. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In many areas where slopes are uniform, the soils are well suited to contouring and terracing. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility and tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

422—Amana silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on bottom lands along major streams and tributaries. It is subject to flooding. Individual areas range from 10 to 35 acres and are irregular in shape.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is very dark gray, friable silt loam about 12 inches thick. The subsoil is about 35 inches thick. The upper part is dark grayish brown, friable silt loam, and the middle and lower parts are dark grayish brown to grayish brown silt loam that has yellowish brown mottles. The substratum to a depth of about 60 inches is grayish brown and light brownish gray, mottled, friable silt loam.

This Amana soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 4 to 5 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but a few areas are in permanent pasture or trees. This soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. It is subject to periodic flooding, however. Protection from overflow is needed in many areas of this soil. Farming operations are generally delayed in spring when the water table is high. Wet areas can be improved by artificial drainage if suitable outlets are available. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability class I.

428B—Ely silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is in long, narrow bands at the foot of hillsides or on alluvial fans where waterways empty into bottom lands. Individual areas range from 5 to 70 acres and are irregular in shape.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is black to very dark gray, friable silty clay loam about 19 inches thick. The subsoil is about 29 inches thick. The upper part is grayish brown, friable silty clay loam that has a few yellowish brown mottles, the middle part is grayish brown, friable silty clay loam that has common yellowish brown mottles, and the lower part is grayish brown, friable silty clay loam that has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is grayish brown, friable silt loam that has strong brown and yellowish brown mottles.

This Ely soil is moderately permeable, and surface runoff from cultivated areas is medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 4 to 6 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. The use of interceptor tile drainage helps remove excess water resulting from seepage from adjacent slopes. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment

of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

430—Ackmore silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained or poorly drained soil is on flood plains and in narrow upland drainageways. It is subject to flooding by runoff from adjacent areas. Individual areas range from 10 to 70 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The substratum is about 20 inches thick. It is stratified, very dark gray and grayish brown, friable silt loam. The buried, black, friable silty clay loam soil is about 17 inches thick. The underlying buried subsoil to a depth of about 60 inches is very dark gray, firm silty clay loam.

Included with this soil in mapping are small areas of Colo silt loam overwash. These areas, which have a shallower silt loam surface layer than Ackmore soil, may be wetter during early seasons of the year. They make up 10 to 15 percent of the unit.

This Ackmore soil is moderately permeable, and surface runoff is slow to medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and is suited to grasses and legumes for hay and pasture. This soil is subject to overflow during periods of high rainfall, and in some years crops can be damaged by water or recent deposition. In most areas the installation of tile drainage is needed. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in trees. Natural and planted seedlings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIw.

442B—Tama-Dickinson complex, 2 to 5 percent slopes. These gently sloping, well drained or somewhat excessively drained soils are on ridgetops in uplands. Many of these ridges are oriented from northwest to southeast. Individual areas range from 5 to 50 acres and are irregular in shape. This map unit is about 55 percent Tama soils and 30 percent Dickinson soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the well drained Tama soil is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is dark brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles.

Typically, the surface layer of the well drained or somewhat excessively drained Dickinson soil is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown to very dark grayish brown, friable to very friable fine sandy loam about 9 inches thick. The subsoil is about 20 inches thick. The upper part is very dark grayish brown and dark brown, very friable fine sandy loam, the middle part is dark brown or brown to dark yellowish brown, very friable fine sandy loam, and the lower part is yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Included with these soils in mapping are small areas of Downs and Sparta soils. These soils are in positions on the landscape similar to those of the Tama and Dickinson soils. They make up about 15 percent of the map unit.

Permeability is moderate in the Tama soil and moderately rapid in the Dickinson soil. Surface runoff is medium on both soils. Available water capacity is high in the Tama soil and moderate in the Dickinson soil. In both soils content of organic matter is about 2 to 4 percent in the surface layer, and reaction ranges from slightly acid to neutral as a result of local liming practices. The Tama subsoil is low in available phosphorus and potassium, and the Dickinson subsoil is very low in available phosphorus and potassium.

Most areas of these soils are cultivated. This map unit is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The Dickinson soil is droughty and is subject to erosion and soil blowing. Newly seeded crops on these soils and adjacent soils are sometimes damaged by blowing sand from the Dickinson soil if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In places contouring is beneficial. Terraces, however, are difficult to construct and maintain in these sandy soils. Returning

crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion and soil blowing. Overgrazing or grazing when the soils are wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are in capability subclass IIe.

442C2—Tama-Dickinson complex, 5 to 9 percent slopes, moderately eroded. These moderately sloping, well drained or somewhat excessively well drained soils are on ridgetops and side slopes in uplands. Many of these ridges are oriented from northwest to southeast. Individual areas range from 5 to 100 acres and are irregular in shape. This map unit is about 50 percent Tama soils and 30 percent Dickinson soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the well drained Tama soil is very dark brown and very dark grayish brown silt loam about 7 inches thick. Some brown subsoil material is mixed with the surface layer. The subsoil is about 22 inches thick. The upper part is dark brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles. In places the surface layer is thicker and darker and has more content of organic matter.

Typically, the surface layer of the well drained or somewhat excessively drained Dickinson soil is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark brown to very dark grayish brown fine sandy loam about 6 inches thick. The subsoil is about 16 inches thick. The upper part is very dark grayish brown and dark brown, very friable fine sandy loam, the middle part is brown or dark yellowish brown, very friable loamy fine sand, and the lower part is yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Included with these soils in mapping are small areas of Downs and Sparta soils. These soils are in positions on the landscape similar to those of the Tama and Dickinson soils. They make up about 20 percent of the map unit.

Permeability is moderate in the Tama soil and moderately rapid in the Dickinson soil. Surface runoff is medium on both soils. Available water capacity is high in the Tama soil and moderate in the Dickinson soil. In both soils the content of organic matter is about 1 to 3 percent in the surface layer, and reaction varies from strongly acid to neutral as a result of local liming practices. The Tama subsoil is low in available phosphorus and potassium, and the Dickinson subsoil is very low in available phosphorus and low in available potassium.

Most areas of these soils are cultivated. This map unit is moderately suited to poorly suited to corn, soybeans, and small grains and is suited to grasses and legumes for hay and pasture. The Dickinson soil is droughty and is subject to soil blowing. Newly seeded crops on this soil and adjacent soils are sometimes damaged by blowing sand from the Dickinson soil if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops prevent excessive soil loss. In some places contouring is beneficial. Terraces, however, are difficult to construct and maintain in these sandy soils. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion and soil blowing. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

442D2—Tama-Dickinson complex, 9 to 14 percent slopes, moderately eroded. These strongly sloping, well drained or somewhat excessively drained soils are on side slopes in uplands. Many of these map units are oriented from northwest to southeast. Individual areas range from 10 to 30 acres and are irregular in shape. This map unit is about 50 percent Tama soils and 30 percent Dickinson soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the well drained Tama soil is very dark brown and very dark grayish brown silt loam about 7 inches thick. Some dark brown subsoil material is mixed with the surface layer. The subsoil is about 20 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has light gray and strong brown mottles. In places the surface layer is thicker and darker and has more content of organic matter.

Typically, the surface layer of the well drained or somewhat excessively drained Dickinson soil is very dark brown, friable fine sandy loam about 7 inches thick. The subsurface layer is very dark brown to very dark grayish brown sandy loam about 6 inches thick. The subsoil is

about 12 inches thick. The upper part is very dark grayish brown and brown, very friable fine sandy loam, the middle part is brown or dark yellowish brown, very friable fine sandy loam, and the lower part is yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Included with these soils in mapping are small areas of Downs and Sparta soils. These soils are in positions on the landscape similar to those of the Tama and Dickinson soils. They make up about 20 percent of the map unit.

Permeability is moderate in the Tama soil and moderately rapid in the Dickinson soil. Surface runoff is medium on both soils. Available water capacity is high in the Tama soil and moderate in the Dickinson soil. In both soils the content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The Tama subsoil is low in available phosphorus and potassium, and the Dickinson subsoil is very low in available phosphorus and low in available potassium.

Most areas of these soils are cultivated. This map unit is poorly suited to corn, soybeans, and small grains but is suited to grasses and legumes for hay and pasture. The Dickinson soil is droughty and is subject to erosion and soil blowing. Newly seeded crops on these soils and adjacent soils are sometimes damaged by blowing sand from the Dickinson soil if they are not protected by vegetation. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. In some places contouring is beneficial. Terraces, however, are difficult to construct and maintain in these sandy soils. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion and soil blowing. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IVe.

453—Tuskeego silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on bottom lands and in concave positions on low foot slopes. It is subject to flooding. Individual areas range from 20 to 70 acres and are irregular or elongated in shape.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsurface layer is dark grayish brown and dark gray silt loam about 10 inches thick. The subsoil is about 33 inches thick. The upper part is dark gray, friable silty clay loam that has yellowish brown mottles, the middle part is dark gray and grayish brown silty clay loam to silty clay that has yellowish brown and grayish brown mottles, and the lower part is olive gray and light olive gray, firm silty clay loam that has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is light olive gray, friable silt loam that has strong brown mottles.

This Tuskeego soil is very slowly permeable, and surface runoff is very slow to ponded. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. If drained, this soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. Some soils are ponded for short periods, and crops are drowned out in some years. The installation of tile drainage or the use of open ditches may be needed to successfully drain all areas of this soil. Because areas are small, the cropping system generally is determined by use of the surrounding soils. If this soil is not drained, it generally is left in permanent pasture. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Because this soil is poorly drained, the use of equipment needs to be restricted to drier periods or to the winter months when the ground is frozen. If needed during wet periods, special high flotation equipment can be used for harvesting or in management. Natural and planted seedlings do not grow well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand and density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIw.

484—Lawson silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on first and second bottoms. It is subject to flooding. Individual areas range from 5 to 80 acres and are broad and slightly irregular in shape.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is black to very dark grayish brown silt loam about 24 inches thick. The

substratum to a depth of about 60 inches is dark grayish brown silt loam that has brown mottles.

This Lawson soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 3 to 5 percent in the surface layer. Reaction in the surface layer and subsoil ranges from slightly acid to mildly alkaline as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If adequately protected from flooding most areas of this soil are suited to intensive row cropping. Levees and dikes may be used to provide flood protection. Tile drainage systems function well if adequate outlets are available. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

485—Spillville loam, 0 to 2 percent slopes. This nearly level, moderately well drained and somewhat poorly drained soil is on bottom lands of major rivers and small streams and in drainageways. It is subject to flooding. Individual areas range from 15 to 100 acres and are elongated and irregular in shape.

Typically, the surface layer is black loam about 20 inches thick. The subsurface layer is black, friable loam about 27 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown loam that has brown mottles. In places small areas of soil are covered with light colored sandy loam overwash 8 to 20 inches thick. In other places sandy loam or loamy sand is at a depth of more than 40 inches.

This Spillville soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 4 to 6 percent in the surface layer. Reaction typically is medium acid to neutral throughout. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Many areas of this soil are cultivated. Areas that are inaccessible or in narrow drainageways generally are in permanent pasture or trees. Although this soil is subject to flooding during periods of heavy rainfall, it is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture if protected from flooding. Because of the seasonal high water table, the installation of tile drainage is needed in some areas. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth. This soil generally does not need liming.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

520—Coppock silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained or poorly drained soil is on stream benches, foot slopes, and alluvial fans. It is subject to flooding. Individual areas range from 2 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 17 inches thick. The subsoil to a depth of about 60 inches is grayish brown, friable silty clay loam that has yellowish brown and strong brown mottles in the upper part and light brownish gray, friable silty clay loam that has yellowish brown and strong brown mottles in the lower part. In places the soil is covered with light colored silt loam overwash 8 to 20 inches thick.

This Coppock soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from slightly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. This soil is in fair tilth.

Many areas of this soil are cultivated, but a few areas are in permanent pasture or are used as wildlife habitat. If adequately drained, this soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. In some areas that are subject to runoff, overflow, and flooding, crops may be drowned out in some years. The installation of tile drainage and the use of open ditches may be needed to successfully drain some areas. In other places diversion terraces are needed to intercept runoff. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if competing vegetation

is controlled or removed by careful site preparation or by spraying, cutting, or girdling. Other hazards or limitations in the planting or harvesting of trees are slight.

This soil is in capability subclass IIw.

539—Perks sandy loam, 0 to 2 percent slopes. This nearly level, excessively drained soil is on broad flood plains. It is subject to flooding. Individual areas range from 10 to 80 acres and are irregular in shape.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, yellowish brown, and dark yellowish brown fine and medium sand, which grades to very dark grayish brown, dark grayish brown, and grayish brown loamy sand that has brown mottles.

This Perks soil is rapidly permeable, and surface runoff is slow. Available water capacity is very low. The content of organic matter is about 0.5 to 1 percent in the surface layer, and reaction ranges from medium acid to slightly acid as a result of local liming practices. The subsoil is very low in available phosphorus and potassium.

Most areas of this soil remain in trees and permanent pasture. A few areas have been cleared and are cultivated. This soil is poorly suited to corn, soybeans, and small grains and moderately well suited to grasses and legumes for hay and pasture. It is subject to flooding if not protected by levees. In addition, this soil is droughty and is subject to soil blowing. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is dry reduces the plant cover and increases the hazard of soil blowing. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVs.

621—Houghton muck, 0 to 2 percent slopes. This nearly level, very poorly drained soil is on broad, upland drainageways and on the lower parts of hillsides that are seepy and wet. A few areas are on stream benches. This soil is subject to ponding. Individual areas range from 2 to 20 acres and are round to elongated in shape.

Typically, this soil is black and very dark grayish brown muck about 60 inches thick.

Permeability ranges from moderately rapid to moderately slow in this Houghton soil, and surface runoff is very slow. The soil has a seasonal high water table near or above the surface. Available water capacity is high. The content of organic matter is more than 70 percent in the surface layer, and reaction ranges from medium acid to mildly alkaline as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. This soil is in fair tilth.

Most areas of this soil have been drained and are cultivated. If drained, this soil is suited to corn and soybeans and to grasses for hay and pasture. The installation of tile or surface drainage and leveling of the hummocky surface are needed before row crops can be grown. Outlets for tile drainage are difficult to obtain in some areas. Considerable settling of the soil takes place after drainage. If this soil is used for cultivated crops, soil blowing is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. This soil generally does not need liming. If not drained, this soil is better suited to use as wetland wildlife habitat.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to trees. Because the soil is very poorly drained, the use of equipment needs to be restricted to drier periods or to the winter months when the ground is frozen. Planted seedlings do not survive well; therefore, they should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIIw.

687—Watkins silt loam, 0 to 2 percent slopes. This nearly level, well drained and moderately well drained soil is on convex slopes of low stream benches that lie a few feet above the flood plain. Individual areas range from 5 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is brown and dark yellowish brown, friable silty clay loam or silt loam about 39 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has a few dark brown iron concretions.

This Watkins soil is moderately permeable, and surface runoff is slow. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for

cultivated crops, soil blowing is a slight hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Diversion terraces placed on soils upslope help protect this soil from siltation. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce soil erosion, reduce crusting, increase water infiltration, and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability class I.

687B—Watkins silt loam, 2 to 5 percent slopes. This gently sloping, well drained and moderately well drained soil is on convex slopes of low stream benches that lie a few feet above the flood plain (fig. 12). Individual areas range from 5 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 2 inches thick. The subsoil is about 37 inches thick. It is brown and dark yellowish brown, friable silty clay loam or silt loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has a few dark brown iron concretions.

Figure 12.—Watkins silt loam, 2 to 5 percent slopes, on a bench along the Iowa River. Steep Fayette soils are in the foreground.

This Watkins soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In some areas contouring and terracing are suited because slopes are uniform. Row crops can be grown more often in the cropping sequence if the soil is terraced. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce soil erosion, reduce crusting, increase water infiltration, and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Planted seedlings survive and grow well if competing vegetation is controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

688—Koszta silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low stream benches or high second bottoms. It is subject to flooding. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, friable silty clay loam that has yellowish brown mottles, the middle part is grayish brown silty clay loam that has yellowish brown mottles, and the lower part is light brownish gray and grayish brown silty clay loam that has strong brown mottles. The substratum to a depth of about 60 inches is light brownish gray silty clay loam that has strong brown mottles.

This Koszta soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil receives runoff from adjacent foot slopes. The installation of tile drainage is not commonly needed but may be beneficial in some areas. The use of diversion terraces may help prevent runoff overflow from adjacent side slopes. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

This soil is suited to hay and pasture in the cropping sequence. Grasses and legumes increase water intake, protect the soil from erosion, and improve tilth. Overgrazing or grazing when the soil is wet causes surface compaction and results in poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native woodland. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability class I.

727—Udolpho loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained or poorly drained soil is on stream benches and outwash areas in uplands. It is subject to flooding. Individual areas range from 5 to 100 acres and are irregular in shape.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 19 inches thick and is mottled. The upper part is dark grayish brown, friable loam, the middle part is grayish brown and light brownish gray, friable loam, and the lower part is grayish brown, very friable sandy loam. The substratum to a depth of about 60 inches is brown or pale brown loamy sand and sand.

This Udolpho soil is moderately permeable in the surface layer and upper part of the subsoil and rapidly permeable in the lower part of the subsoil and substratum. Surface runoff is slow. The soil has a seasonal high water table. Available water capacity is moderate. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to slightly acid as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated, but a few areas are in permanent pasture. This soil is moderately well suited to corn, soybeans, and small grains, although droughtiness may be a hazard during seasons of less than normal rainfall. It is also suited to grasses and legumes for hay and pasture. In some areas artificial drainage is beneficial during wet seasons. Installation of

tile is difficult, however, because of the loose, water bearing sand and gravelly sand. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Because this soil is somewhat poorly drained and poorly drained, the use of equipment needs to be restricted to drier periods or to the winter months when the ground is frozen. If needed during wet periods, special high flotation equipment can be used for harvesting or in management. Natural and planted seedlings do not survive well; therefore, seedlings should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IIw.

729B—Nodaway-Arenzville silt loams, 1 to 4 percent slopes. These very gently sloping and gently sloping, moderately well drained soils are in narrow bottom lands and drainageways that extend into the highly dissected, loess covered uplands. They are subject to seasonal flooding. Individual areas range from 15 to 200 acres and are irregular in shape. This map unit is about 50 percent Nodaway soils and 40 percent Arenzville soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the Nodaway soil is very dark grayish brown and dark grayish brown silt loam 6 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, dark grayish brown, and grayish brown, stratified, friable silt loam.

Typically, the surface layer of the Arenzville soil is dark grayish brown silt loam about 11 inches thick. The substratum is 22 inches thick. It is dark gray, dark grayish brown, and brown, stratified, friable silt loam. Below that is an older buried surface layer. It is black silt loam and silty clay loam about 21 inches thick. The underlying layer to a depth of about 60 inches is very dark gray, friable silty clay loam.

Included with these soils in mapping are small areas of poorly drained Colo silt loam overwash near the center of the drainageways. This recent overwash is less than 20 inches thick over black silty clay loam. These areas make up about 10 percent of the unit.

These Nodaway and Arenzville soils are moderately permeable, and surface runoff is slow. These soils have a seasonal high water table. Available water capacity is high in both soils. The content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from slightly acid to mildly alkaline as a result of local liming practices. The Nodaway subsoil is medium in available phosphorus and potassium, and the Arenzville subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on these soils.

Most areas of this map unit are in pasture or trees, but some areas are cultivated. These soils are suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If these soils are used for cultivated crops, flooding and gully erosion are hazards. Many areas of these soils are in very narrow drainageways that cannot be cultivated and are subject to flooding. These areas are left in trees or permanent pasture. In some of the larger areas, excess water from the hillsides is diverted to permit cultivation. There are also small areas that are dissected by one or more gullies or waterways. In some of these places, waterways can be shaped and seeded to help prevent gully erosion, but in other places, structures are also needed to prevent gullies from forming. Some areas that are seasonally wet due to seepage from upland soils may need the installation of tile drainage to permit timely field operations. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of these soils for pasture and hay helps to control erosion or the formation of gullies. Overgrazing or grazing when the soils are wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are moderately well suited to trees, and a few areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

These soils are in capability subclass IIe.

760—Ansgar silt loam, 0 to 3 percent slopes. This nearly level and very gently sloping, poorly drained soil is on flat or depressional areas or in shallow drainageways in uplands. Individual areas range from 3 to 25 acres and are irregular in shape.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 43 inches thick and is mottled. The upper part is dark grayish brown, friable silty clay loam, the middle part is dark grayish brown and grayish brown, friable silty clay loam, and the lower part is grayish brown, friable sandy loam that grades to mottled yellowish brown and light gray, firm loam. The substratum to a depth of about 60 inches is yellowish brown firm loam. Sand lenses are common at the boundary between the loess and the

glacial till. In places the underlying loam glacial till is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Franklin soils, which are not so wet as this Ansgar soil. These areas make up 5 to 10 percent of the unit.

This Ansgar soil is moderately permeable. Surface runoff is very slow and is subject to ponding. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain in this soil; however, heavy rainfall causes puddling if the soil is worked when wet.

Most areas of this soil are cultivated, but a few areas are in permanent pasture or are used as wildlife habitat. If drained, this soil is well suited to corn, soybeans, and small grains and is suited to grasses and legumes for hay and pasture. Some areas are subject to ponding, and crops drown out. The installation of tile drainage and the use of surface drains are needed if this soil is tilled and crops are grown. However, not all areas can be satisfactorily drained by tile. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

761—Franklin silt loam, 1 to 3 percent slopes. This very gently sloping, somewhat poorly drained soil is on flat, broad divides or in concave positions at the heads of drainageways. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 29 inches thick. The upper part is dark grayish brown, friable silt loam and silty clay loam that has yellowish brown mottles, and the lower part is grayish brown and yellowish brown, mottled, firm loam. Sand lenses are common at the boundary between the silty clay loam and the loam. The substratum to a depth of about 60 inches is mottled yellowish brown and light brownish gray, firm loam.

Included with this soil in mapping are small areas of poorly drained Ansgar soils that are wetter than this Franklin soil. These soils generally are in slight depressions. They make up 5 to 10 percent of the unit.

This Franklin soil is moderately permeable, and surface runoff is slow to medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from extremely acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Not all areas of this soil need tile drainage, but crops are benefited and earlier field operations are possible if tile is installed. On the most sloping parts of these soils, a combination of erosion control practices and tile drainage is advisable if row crops are grown intensively. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability class I.

771B—Waubeek silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained and well drained soil is in convex positions on ridges and side slopes in uplands. Individual areas range from 5 to 60 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 4 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown to yellowish brown, friable silty clay loam, and the lower part is yellowish brown, firm loam that has a few grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown, firm loam that has grayish brown mottles. Sand lenses are common at the boundary between the silty clay loam and the loam. In places silty material is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of soil that contain more sand than the Waubeek soil. This soil is lower in content of organic matter and is droughty. These areas make up 5 to 10 percent of the unit.

This Waubeek soil is moderately permeable, and surface runoff is medium. Available water capacity is

high. The content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

771C2—Waubeek silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained and well drained soil is on rounded ridges and side slopes in uplands. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. Some dark brown silty clay loam subsoil material is mixed with the surface layer. The subsoil is about 27 inches thick. The upper part is dark brown to yellowish brown, friable silty clay loam, and the lower part is yellowish brown, firm loam that has a few grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown, firm loam that has grayish brown mottles. Sand lenses are common at the boundary between the silty clay loam and the loam.

This Waubeek soil is moderately permeable, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. This soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grain and well suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Contouring and terracing are well suited to some areas that have uniform slopes. In constructing terraces, however, cuts should be held to a minimum to avoid exposing the underlying glacial till, which is lower in fertility. Areas of this soil that are terraced can be planted to row crops more often in the rotation. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIIe.

778—Sattre loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream benches or in outwash areas in uplands. Individual areas range from 2 to 35 acres and are narrow and irregular in shape.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is dark brown, friable loam about 5 inches thick. In some areas the dark brown subsurface layer has been mixed into the surface layer by plowing. The subsoil is about 29 inches thick. The upper part is dark yellowish brown, friable loam and sandy clay loam, and the lower part is dark yellowish brown, loose, very friable sandy loam and loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand that contains some gravel.

Included with this soil in mapping are small areas of soil that are shallower to sand and gravel than the Sattre soil and are more droughty. These areas make up 5 to 10 percent of the unit.

This Sattre soil is moderately permeable in the surface layer and upper part of the subsoil and very rapidly permeable in the rest of the subsoil and the substratum. Surface runoff is slow. Available water capacity is low to moderate. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction typically is slightly acid but varies as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Droughtiness is a hazard in most years unless rainfall is timely. If this soil is used for cultivated crops, erosion is a hazard on areas that are

plowed in the fall and left unprotected. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay tends to increase the biological activity in this soil. Overgrazing or grazing when the soil is dry, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few areas remain in native hardwoods. Seedling mortality is low, but plant competition is moderate. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling. The hazards or limitations for planting or harvesting trees are slight.

This soil is in capability subclass IIs.

778B—Sattre loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream benches in outwash areas in uplands. Individual areas range from 2 to 10 acres and are irregular in shape.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is dark brown loam about 5 inches thick. In some areas the dark brown subsurface layer has been mixed into the surface layer by plowing. The subsoil is about 27 inches thick. The upper part is yellowish brown, friable loam and sandy clay loam, and the lower part is yellowish brown, loose, very friable sandy loam and loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand that contains some gravel.

Included with this soil in mapping are small areas that are shallower to sand and gravel than the Sattre soil and are more droughty. These areas make up 5 to 10 percent of the unit.

This Sattre soil is moderately permeable in the surface layer and upper part of the subsoil and very rapidly permeable in the rest of the subsoil and substratum. Surface runoff is medium, and available water capacity is low to moderate. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction typically is slightly acid but varies as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard on areas that are plowed in the fall and left unprotected. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is dry, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few areas remain in native hardwoods. Seedling mortality is low, but plant competition is moderate. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling. The hazards or limitations for planting or harvesting trees are slight.

This soil is in capability subclass IIe.

792D2—Armstrong loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained or somewhat poorly drained soil is on shoulders of convex side slopes in uplands. Individual areas range from 5 to 25 acres and are in narrow bands.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. Some dark yellowish brown loam material is mixed with the surface layer. The subsoil to a depth of about 60 inches is dark yellowish brown, friable loam in the upper part, mottled brown and red, firm clay loam and clay in the middle part, and mottled yellowish brown, firm clay loam in the lower part. A band of pebbles is in the upper part of the subsoil.

This Armstrong soil is slowly permeable, and surface runoff is rapid. The soil has a seasonal high water table. Available water capacity is moderately high. The content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. During the spring, seeps are common in this soil due to the perched water table. Typically, these soils are in fair tilth.

Most areas of this soil are in permanent pasture or trees. This soil is suited to occasional row crops in rotation with small grains and to grasses and legumes for hay and pasture, but it is better suited to hay and pasture. If this soil is used for cultivated crops, damage from further erosion is a severe hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help prevent excessive soil loss. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees. Planted seedlings do not survive well; therefore, they should be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass IVe.

793—Bertrand silt loam, 1 to 3 percent slopes. This very gently sloping, well drained soil is on benches adjacent to major streams and rivers. Individual areas range from 5 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil to a depth of about 60 inches is yellowish brown and dark yellowish brown, friable silt loam in the upper and middle parts and yellowish brown, very friable loamy sand in the lower part.

This Bertrand soil is moderately permeable in the surface layer and upper part of the subsoil and rapidly permeable in the rest of the subsoil. Surface runoff is medium, and available water capacity is high. The content of organic matter is about 1 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil blowing. In some areas the use of properly placed diversion terraces can protect this soil from siltation from the higher lying soils. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability class I.

826—Rowley silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on benches along major streams and tributaries. It is subject to flooding. Individual areas range from 5 to 25 acres and are irregular in shape.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is black and very dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 29 inches thick. The upper part is dark grayish brown, friable silt loam that has yellowish brown mottles, and the middle and lower parts are brown to light brownish gray, friable silt loam that has yellowish brown mottles. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam and silty clay loam that has yellowish brown mottles.

This Rowley soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 5 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The use of diversion terraces placed on adjacent upland slopes can protect this soil from runoff and siltation. Because of the seasonal high water table, the installation of tile drainage is helpful in improving the timeliness of field operations. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

876B—Ladoga silt loam, benches, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is in convex positions on ridges and side slopes on stream benches. Individual areas range from 5 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam, the middle part is brown, firm silty clay loam that has yellowish brown and light brownish gray mottles, and the lower part is brown, firm silty clay loam that has light brownish gray and gray mottles. The substratum to a depth of about 60 inches is mottled brown and light brownish gray, firm silty clay loam. It is underlain by stratified sand at a depth of more than 60 to 96 inches. In places the surface layer is thicker and darker and is higher in content of organic matter.

Permeability is moderately slow in this Ladoga soil, and surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from slightly acid to neutral as a result of local liming

practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, damage from erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Contouring and terracing are well suited to some areas where the slopes are uniform. Returning crop residue or the regular addition of other organic material helps improve fertility, control soil erosion, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing, however, causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIe.

920—Tama silt loam, sandy substratum, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces and in uplands. Individual areas range from 5 to 20 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown to very dark grayish brown, friable silt loam that grades to silty clay loam. It is about 11 inches thick. The subsoil is about 30 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam and very friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow and yellow, very friable, loose sand.

This Tama soil is moderately permeable in the surface layer and rapidly permeable in the substratum. Surface runoff is slow, and available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay helps improve permeability. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is in capability class I.

920B—Tama silt loam, sandy substratum, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream terraces and on uplands. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown to very dark grayish brown silt loam that grades to silty clay loam. It is about 10 inches thick. The subsoil is about 28 inches thick. The upper part is brown, friable silty clay loam, the middle part is dark yellowish brown and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam and very friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow and yellow, very friable, loose sand.

This Tama soil is moderately permeable in the surface layer and subsoil and rapidly permeable in the substratum. The surface runoff is medium, and available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. Contouring and terracing are well suited to this soil because slopes are uniform. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay helps improve permeability and control erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, results in poor tilth, and reduces production. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

962—Elvira silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on alluvial flood plains, low stream benches, and in shallow depressions at some distance from the main stream channel. It is

subject to flooding. Individual areas are about 50 acres and are irregular or elongated in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black silty clay loam about 10 inches thick. The subsoil is about 29 inches thick. The upper part is very dark gray and black, firm silty clay loam that has strong brown and yellowish red mottles, the middle part is very dark gray and dark gray, firm silty clay loam and clay loam that contains reddish brown oxides, and the lower part is dark gray, firm clay loam and silty clay loam that has reddish brown oxides. The substratum to a depth of about 60 inches is gray, firm silty clay loam that has light olive brown mottles.

This Elvira soil is moderately permeable, and surface runoff is slow. It is subject to ponding in depressional areas. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 7 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of liming practices. The subsoil generally is medium in available phosphorus and very low in available potassium. This soil is in fair tilth. It puddles readily when wet and becomes cloddy and hard when dry.

Most areas of this soil are used for cultivated crops and hay. A few undrained areas are used for pasture. This soil is suited to corn, soybeans, and small grains and to grasses for hay and pasture. Because this soil is poorly drained, cultivation is often delayed unless artificial drainage is used. If adequate outlets are available, the installation of tile drainage is fairly successful. In some areas where flooding is frequent or the soil is ponded, establishing a good stand of row crops is difficult. Because this soil contains high concentrations of iron that can affect the availability of some plant nutrients, special applications of fertilizer may be needed to correct nutrient imbalances. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, use should be restricted during wet periods to help keep the pasture and soil in good condition. Overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

974B—Bolan loam, loamy substratum, 2 to 5 percent slopes. This gently sloping, well drained soil is in convex positions on ridgetops in the uplands. Individual areas range from 2 to 25 acres and are narrow and irregular in shape.

Typically, the surface layer is very dark brown loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 12 inches thick. The subsoil is about 41 inches thick. The upper part is brown, friable clay loam, and the middle part is dark yellowish brown and yellowish brown, very friable, loose sandy loam, loamy sand, and sand. The lower part is yellowish brown, firm loam that has light brownish gray, brown, and strong brown mottles.

Permeability is moderate in the upper part of this Bolan soil and rapid in the lower part. Surface runoff is medium, and available water capacity is moderate. The content of organic matter is 3 to 4 percent in the surface layer, and reaction typically is medium acid. Reaction varies, however, as a result of local liming practices. The subsoil is very low in available phosphorus and low to medium in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, small grains, and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent soil loss. Contouring and terracing are well suited to most areas of this soil, because slopes are uniform. Returning crop residue or the regular addition of other organic material helps improve fertility, reduce crusting, and increase water infiltration.

The use of this soil for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poor tilth and reduces production. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

976—Raddle silt loam, 1 to 3 percent slopes. This very gently sloping, well drained soil is on benches adjacent to major streams and rivers. Individual areas range from 5 to 50 acres and are irregular in shape.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown and dark brown silt loam about 15 inches thick. The upper and middle parts of the subsoil are dark yellowish brown and yellowish brown, friable silt loam, and the lower part to a depth of 60 inches is dark brown, friable loam.

This Raddle soil is moderately permeable, and surface runoff is slow to medium. Available water capacity is high. The content of organic matter is about 2 to 5 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. In some areas

the use of properly placed diversion terraces help protect this soil from siltation from the higher lying soils. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

993D2—Gara-Armstrong loams, 9 to 14 percent slopes, moderately eroded. These strongly sloping, somewhat poorly drained, moderately well drained, or well drained soils are on ridgetops and side slopes in uplands. Individual areas range from 5 to 15 acres and are irregular in shape. This map unit is about 60 percent Gara soils and 40 percent Armstrong soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the well drained to moderately well drained Gara soil is very dark gray, dark grayish brown, and yellowish brown loam about 7 inches thick. The subsurface layer and part of the subsoil have been mixed into the surface layer by plowing. The subsoil is about 40 inches thick. The upper part is dark yellowish brown, friable loam, and the middle and lower parts are yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam that has a few fine faint grayish brown mottles.

Typically, the surface layer of the moderately well drained or somewhat poorly drained Armstrong soil is very dark grayish brown and dark yellowish brown loam about 7 inches thick. The subsurface layer and part of the subsoil have been mixed into the surface layer by plowing. The subsoil to a depth of about 60 inches is dark yellowish brown, friable loam in the upper part, brown, reddish brown, and yellowish brown, firm clay loam that grades to clay in the middle part, and mottled yellowish brown and light brownish gray, firm clay loam in the lower part.

Permeability is moderately slow in the Gara soil and slow in the Armstrong soil. The Armstrong soil has a seasonal high water table. Surface runoff is medium to rapid on both soils. Available water capacity is high in both soils. During the spring seeps are common in the Armstrong soil due to the perched water table. In both soils the content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The Gara subsoil is very low to low in available phosphorus and very low in available potassium, and the Armstrong subsoil is very low in available phosphorus and potassium. Both soils are in fair tilth.

Most areas of this map unit are cultivated, but some areas are in permanent pasture or trees. These soils are suited to occasional row crops grown in rotation with small grains and grasses and legumes for hay and pasture, but they are better suited to hay and pasture. If these soils are used for cultivated crops, damage from further erosion is a hazard. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. In places contouring is beneficial. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soils are wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees. Seedlings planted in areas of the Gara soil survive well if adapted species are selected and proper management is used. Seedlings planted in areas of the Armstrong soil, however, do not survive well; therefore, they should be planted close together and thinned later to achieve the desired stand density.

This soil is in capability subclass IVe.

993E2—Gara-Armstrong loams, 14 to 18 percent slopes, moderately eroded. These moderately steep, somewhat poorly drained, moderately well drained, or well drained soils are on ridgetops and side slopes in uplands. Individual areas range from 5 to 50 acres and are irregular in shape. This map unit is about 60 percent Gara soils and 40 percent Armstrong soils. These soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the well drained to moderately well drained Gara soil is very dark gray, dark grayish brown, and yellowish brown loam about 7 inches thick. The subsurface layer and part of the subsoil have been mixed into the surface layer by plowing. The subsoil is about 35 inches thick. The upper part is dark yellowish brown, friable loam, and the middle and lower parts are yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam that has a few fine faint grayish brown mottles.

Typically, the surface layer of the moderately well drained or somewhat poorly drained Armstrong soil is very dark grayish brown and dark yellowish brown, friable loam about 7 inches thick. The subsurface layer and part of the subsoil have been mixed into the surface layer by plowing. The subsoil is about 45 inches thick. The upper part is dark yellowish brown, friable loam, the middle part

is brown, reddish brown, and yellowish brown, firm clay loam that grades to clay, and the lower part is mottled yellowish brown and light brownish gray, firm heavy clay loam.

Permeability is moderately slow in the Gara soil and slow in the Armstrong soil. Surface runoff ranges from medium to rapid on both soils. Available water capacity is high in both soils. During the spring, seeps are common in the Armstrong soil due to the perched water table. In both soils the content of organic matter is about 1 to 2 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The Gara subsoil is very low to low in available phosphorus and potassium, and the Armstrong subsoil is very low in available phosphorus and potassium. Both soils are in fair tilth.

Most areas of this map unit are in permanent pasture or trees. These soils are not suited to cultivated crops. They are better suited to hay and pasture. If the soils are used for cultivated crops, damage from further erosion is a severe hazard.

The use of these soils for pasture or hay is an effective means of controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

These soils are moderately suited to trees, and a few small areas remain in native hardwoods. Careful consideration should be given to the location of trails or roads used in logging so that the hazard of erosion can be reduced. Laying out trails or roads on the contour or nearly on the contour reduces soil erosion. Because the slope of these soils is moderately steep, the operation of farm equipment is somewhat hazardous. Special equipment can be used, but caution is needed in its operation. Although natural and planted seedlings survive and grow well on the Gara soils, they do not survive well on the Armstrong soil. Therefore, on the Armstrong soil, seedlings should be planted close together and thinned later to achieve the desired stand density.

These soils are in capability subclass VIe.

1119—Muscatine silt loam, benches, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on loess covered stream benches. Individual areas range from 5 to 25 acres and are irregular in shape.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is black and very dark brown silty clay loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is very dark grayish brown, friable silty clay loam, the middle part is dark grayish brown, friable silty clay loam that has yellowish brown mottles, and the lower part is grayish brown, friable silty clay loam and silt loam that have yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has yellowish brown and strong brown mottles. It is underlain by stratified sand at a depth of more than 60 inches. In some areas the soil is as shallow as 48 inches in depth. In places the surface layer is silty clay loam. In other places the slope ranges from 2 to 5 percent.

This Muscatine soil is moderately permeable, and surface runoff is slow. This soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 6 percent in the surface layer, and reaction varies from strongly acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The soil commonly receives runoff from adjacent slopes. The installation of tile drainage improves the timeliness of field operations. In some areas, diversion terraces are needed on the soils upslope to prevent runoff and siltation on this soil. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

1160—Walford silt loam, benches, 0 to 1 percent slopes. This nearly level to slightly depressed, poorly drained soil is on loess covered stream benches. Individual areas range from 2 to 10 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is grayish brown and dark grayish brown, friable silty clay loam that has yellowish brown mottles, and the middle part is grayish brown, firm silty clay loam that has strong brown mottles, grading to grayish brown, firm silty clay loam and silty clay loam that have strong brown mottles. The lower part is mottled olive brown, brown, and yellowish brown, firm silty clay loam. The substratum to a depth of about 60 inches is mottled light olive gray, brown, and strong brown, friable silt loam. It is underlain by stratified sand at a depth of more than 60 inches. In some areas the soil is as shallow as 48 inches in depth.

This Walford soil is slowly permeable, and surface runoff is slow to ponded. The soil has a seasonal high water table. Available water capacity is high. The content

of organic matter is about 2 to 3 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is very low in available phosphorus and potassium. Good tilth is easy to maintain on this soil. Heavy rainfall, however, causes this soil to puddle if worked when wet.

Most areas of this soil are cultivated, but a few areas are in permanent pasture or are used as wildlife habitat. If drained, this soil is suited to corn and soybeans and to grasses and legumes for hay and pasture. Some areas are ponded for short periods, and crops drown out in some years. The construction of open ditches for drainage together with the installation of tile drainage may be needed to successfully lower the seasonal high water table. Areas that are not drained generally are left idle. Some small, isolated areas are left idle in wet years or are used as wildlife habitat. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain tilth.

If this soil is used for pasture or hay, overgrazing or grazing when the soil is wet causes surface compaction, increases runoff, and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IIw.

1220—Nodaway silt loam, channeled, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flood plains that are dissected by meandering streams and oxbows. This soil is subject to flooding. Individual areas range from 20 to 80 acres and are irregular and elongated in shape.

Typically, the surface layer is very dark grayish brown and dark grayish brown silt loam about 6 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, dark grayish brown, and grayish brown, stratified, friable silt loam. In places small areas of soil that has formed in recent alluvium are less than 40 inches thick.

This Nodaway soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. Reaction typically is slightly acid to neutral throughout. The subsoil is medium in available phosphorus and potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are in pasture or trees. This soil is not suited to corn, soybeans, and small grains because the hazard of flooding is severe and old stream channels are ponded for long periods. In addition, many old stream channels and oxbows prevent the accessibility of farm machinery.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees, and a few small areas remain in native hardwoods. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass Vw.

1280—Mahaska silty clay loam, benches, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream benches. Individual areas range from 5 to 20 acres and are irregular in shape.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsurface layer is black to very dark gray silty clay loam about 14 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, friable silty clay loam, and the middle and lower parts are grayish brown and olive gray, firm silty clay loam that has yellowish brown and strong brown mottles. The substratum to a depth of about 60 inches is light olive gray, friable silt loam that has yellowish brown and strong brown mottles. It is underlain by stratified sand at a depth of more than 60 to 96 inches.

This Mahaska soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 5 to 6 percent in the surface layer, and reaction ranges from strongly acid to neutral as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, helps prevent excessive soil loss. The installation of tile drainage is helpful in improving the timeliness of field operations in years of more than normal rainfall. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability class I.

1291—Atterberry silt loam, benches, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on loess-covered stream benches. Individual areas range from 5 to 15 acres and are irregular in shape.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silty clay loam, the middle part is grayish brown and gray, friable silty clay loam that has yellowish brown mottles, and the lower part is mottled light brownish gray and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, friable silt loam that has yellowish brown mottles. It is underlain by stratified sand at a depth of more than 60 inches. In some areas the soil is as shallow as 48 inches in depth.

Included with this soil in mapping are small areas of poorly drained Walford soils on benches. These areas make up 5 to 10 percent of the unit.

This Atterberry soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 2.5 to 4 percent in the surface layer, and reaction ranges from medium acid to neutral as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil. At times intense rainfall causes the surface layer to puddle, which results in increased runoff and retards plant growth.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The installation of tile drainage is helpful in improving the timeliness of field operations in years of more than normal rainfall. In some areas, the use of diversion terraces on the soils upslope help prevent runoff and siltation on this soil. Returning crop residue or the regular addition of other organic material helps improve fertility and maintain good tilth.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled or removed.

This soil is in capability class I.

1315—Perks-Spillville complex, 0 to 2 percent slopes. These nearly level, somewhat poorly drained, moderately well drained, or excessively drained soils are on flood plains of larger streams and tributaries. These soils are subject to flooding. Individual areas range from 35 to 200 acres and are long and narrow or wide and irregular in shape. Most areas, however, are bisected by rivers, streams, or old stream channels. This map unit is about 50 percent Perks soils and 35 percent Spillville soils. Areas are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the Perks soil has a surface layer of very dark brown sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, yellowish brown, and dark yellowish brown sand that grades to very dark grayish brown, dark grayish brown, and grayish brown sandy loam or loamy sand that has brown mottles.

Typically, the surface layer of the Spillville soil is black loam about 20 inches thick. The subsurface layer is black loam that has brown mottles. It is about 27 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, friable loam that has brown mottles.

Included with this soil in mapping are small areas of poorly drained Coland soils near streams. These areas make up about 15 percent of the unit.

The Perks soil is rapidly permeable, and the Spillville soil is moderately permeable. Surface runoff is slow on both soils. The Spillville soil has a seasonal high water table. Available water capacity is very low in the Perks soil and high in the Spillville soil. The content of organic matter is about 0.5 to 1 percent in the Perks soil and 4 to 6 percent in the Spillville soil. Reaction in the surface layer of the Perks soil ranges from medium acid to slightly acid as a result of local liming practices. The Spillville soil is generally neutral. The Perks subsoil is very low in available phosphorus and potassium, and the Spillville subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on the Spillville soil.

Most areas of this map unit are in trees and permanent pasture, but a few areas have been cleared and are cultivated. These areas consist of old channels (fig. 13), low natural levees, small ponds, sloughs, and small oxbows. They are not suited to corn, soybeans, and small grains unless protected by levees. In addition, land leveling and surface drainage may be needed so that the oxbows and sloughs are accessible to farm machinery.

If these soils are used for pasture, grazing when the soils are wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

The Perks soil is moderately suited to trees, and a few areas remain in native hardwoods. Seedlings in areas of the Perks soil do not survive well; therefore, they should be planted close together and thinned later to achieve the desired stand density. Except for the hazard of frequent flooding, these soils have few limitations.

This map unit is in capability subclass Vw.

Figure 13.—A view of the topography on old glacial "Lake Calvin." Perks-Spillville complex, 0 to 2 percent slopes, is in old, abandoned stream channels. Wiota silt loam, 1 to 3 percent slopes, is on the terraces on the right.

1316—Fluvaquents, ponded. These nearly level, poorly drained or very poorly drained soils are within the Coralville Reservoir water storage area. This unit consists of old channels, small oxbow ponds, sloughs, and low natural river levees. The soil material, which has been recently deposited by the river, is highly stratified and has not been in place long enough for the formation of a uniform sequence of soil horizons. Soils are dominantly loamy and clayey, but thin layers of other soil textures are common.

Fluvaquents, ponded, have different permeabilities due to the variability of the soil material. The available water capacity is very high, and vegetation has died in many areas as a result of standing water. The content of the organic matter is variable. Reaction of this recently deposited material is generally neutral to slightly acid.

Water-loving plants grow in most areas, and water-tolerant trees grow in ponded areas where water does not remain long. These soils are generally unsuited to cultivated crops, pasture, or hay except in very dry years when the water level in the storage area is limited to the permanent pool. They are better suited to wetland plants and trees and to use as wildlife habitat.

These soils are in capability subclass VIIw.

1484—Lawson silt loam, channeled, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains that are dissected by meandering streams and oxbows. This soil is subject to flooding. Individual areas range from 10 to 80 acres and are irregular and elongated in shape.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is black to very dark grayish brown, friable silt loam about 22 inches thick. The substratum to a depth of about 60 inches is dark grayish brown silt loam that has brown mottles. In places

small areas have a dark buried soil at a depth of 20 to 40 inches.

This Lawson soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 3 to 5 percent in the surface layer, and reaction ranges from slightly acid to mildly alkaline as a result of local liming practices. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are in pasture or trees. This soil is not suited to corn, soybeans, and small grains because the hazard of flooding is severe and old stream channels are ponded for long periods. In many places the old stream channels and oxbows prevent the accessibility of farm machinery. If cultivated crops are grown, land leveling, flood control, and surface drainage are needed in many areas.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass Vw.

1485—Spillville loam, channeled, 0 to 2 percent slopes. This nearly level, moderately well drained and somewhat poorly drained soil is on bottom lands of small streams and drainageways that are dissected by meandering streams. This soil is subject to flooding. Individual areas range from 15 to 50 acres and are elongated and irregular in shape.

Typically, the surface layer is black loam about 20 inches thick. The subsurface layer is black, friable loam about 27 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown, friable heavy loam. In places small areas of light colored overwash range from 8 to 20 inches in thickness.

This Spillville soil is moderately permeable, and surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is about 4 to 6 percent in the surface layer. Reaction ranges from medium acid to neutral throughout. The subsoil is low in available phosphorus and very low in available potassium. Good tilth is easy to maintain on this soil.

Most areas of this soil are in pasture or trees. This soil is not suited to cultivated crops or to grasses for hay because the hazard of flooding is severe and old stream channels are ponded for long periods. In many places the old stream channels and oxbows prevent accessibility by farm machinery. If cultivated crops are grown, land leveling, flood control, and surface drainage are needed in many areas.

If this soil is used for pasture, overgrazing or grazing when the soil is wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass Vw.

2422—Amana-Lawson-Perks complex, 0 to 2 percent slopes. These nearly level, somewhat poorly drained or excessively drained soils are on flood plains of the Iowa River and tributaries. These soils are subject to flooding. Individual areas range from 40 to 100 acres and are elongated and narrow or wide and irregular in shape. This map unit is 40 percent Amana soils, 30 percent Lawson soils, and 20 percent Perks soils. The soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the somewhat poorly drained Amana soil is black silt loam about 7 inches thick. The subsurface layer is very dark gray silt loam about 7 inches thick. The upper part is dark grayish brown silt loam, and the middle and lower parts are dark grayish brown to grayish brown silt loam that has yellowish brown mottles. The substratum to a depth of about 60 inches is gray, mottled silt loam.

Typically, the surface layer of the somewhat poorly drained Lawson soil is black silt loam about 7 inches thick. The subsurface layer is black to very dark grayish brown, friable silt loam about 24 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, mottled silt loam that has brown mottles.

Typically, the surface layer of the excessively drained Perks soil is very dark brown sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, yellowish brown, and dark yellowish brown, fine to medium sand that grades to very dark grayish brown, dark grayish brown, and grayish brown sandy loam or loamy sand that has brown mottles.

Included with these soils in mapping are small areas of poorly drained Colo soils near the streams. This soil makes up about 10 percent of the unit.

The Amana and Lawson soils are moderately permeable, and the Perks soil is rapidly permeable. Surface runoff is slow on all of the soils. The Amana and Lawson soils have seasonal high water tables. Available water capacity is high in the Amana and Lawson soils and very low in the Perks soil. The content of organic matter is about 4 to 5 percent in the surface layer of the Amana soil, 3 to 5 percent in the Lawson soil, and 0.5 to 1 percent in the Perks soil. Reaction in the surface layer of all of these soils ranges from medium acid to mildly alkaline but varies as a result of local liming practices. The subsoils of the Amana and Lawson soils are low in available phosphorus and very low in available potassium, and the subsoil of the Perks soil is very low in available phosphorus and potassium. Good tilth is easy to maintain in the Amana and Lawson soils.

Most areas of these soils are in trees and permanent pasture. Other areas have been cleared and are cultivated. Unless protected by levees, these soils are poorly suited to corn, soybeans, and small grains. Land leveling and the installation of surface drainage may be needed so that oxbows and sloughs are accessible by farm machinery. Even in areas that are already drained, a crop may drown out in areas where the soil is flooded and recent material is deposited on the plants. In addition, soil blowing is a hazard on the Perks soil.

If these soils are used for pasture, grazing when the soils are wet causes surface compaction and results in poorer tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soils in good condition.

These soils are suited to trees, and a few areas remain in native hardwoods on bottom lands. Seedlings in areas of the Perks soil do not survive well; therefore, they should be planted close together and thinned later to achieve the desired stand density. Plant competition is a limitation on the Amana soil. Competing vegetation can be controlled or removed by site preparation or by spraying, cutting, or girdling. Except for the hazard of flooding, these soils have slight limitations.

These soils are in capability subclass IIIw.

5010—Pits, sand and gravel. This map unit consists of pits from which sand and gravel have been mined for use for roads and construction purposes. These pits range from 2 acres to more than 50 acres and are irregular in shape. They range from 10 to 30 feet in depth. Piles of sand and gravel that range from 10 feet to more than 30 feet in height surround the pits. Some of the pits contain water that ranges from 2 feet to more than 20 feet in depth. These pits have steep sidewalls.

The spoil surrounding the pits is variable in texture but generally is about 40 to 70 percent sand and small amounts of gravel. In a few places the spoil has been leveled and smoothed, but in other places it is irregularly shaped and very uneven. Leveled areas are reasonably easy to vegetate to trees and grasses. Reaction of the spoil varies from medium acid to mildly alkaline.

Some abandoned pits have been smoothed and seeded to grasses. Other areas that were left rough have a dense growth of brush, trees, grasses, and weeds. All of the pits have good potential for use as wildlife habitat. Pits that contain water more than 15 feet deep generally support fish and are mostly mapped as water areas. Because of the danger associated with the steep sidewalls and variable depth of the water, however, use of these pits for recreational purposes is somewhat limited. Onsite investigation is needed for each site.

This map unit is not assigned to a capability subclass.

5030—Pits, limestone quarry. This map unit consists of pits from which limestone has been quarried for use primarily for roads and construction purposes and for agricultural lime (fig. 14). These pits range from 2 acres to as much as 120 acres and are irregular in shape. They range from 20 feet to more than 40 feet in depth. Piles of ground limestone that range from 10 feet to more than 30 feet in height surround the pits. Some of the pits contain water that ranges from a few feet to many feet in depth. These pits have steep sidewalls.

The spoil surrounding the pits is loess, loam glacial till, or a mixture of the two. It is mostly loamy, however, and contains fragments of limestone. In a few places the spoil has been leveled and smoothed, but in other places the spoil is irregularly shaped and very uneven. Leveled areas are reasonably easy to vegetate to grasses and trees. Reaction of the spoil varies but generally ranges from medium acid to mildly alkaline. It seldom is strongly acid.

These areas have good potential for use as wildlife habitat. Quarries that contain water support fish; however, because of the danger associated with the variable depth of the water and the steep sidewalls, use of these quarries for recreational purposes is somewhat limited. Onsite investigation is needed to determine the safety of each site.

This map unit is not assigned to a capability subclass.

5040—Orthents, loamy. This map unit consists of moderately well drained to somewhat excessively drained soil that has been reshaped during industrial, highway, or residential construction. The original soils have been changed to the extent that they are no longer recognizable. Individual areas range from 5 to 50 acres.

The soil material is dominantly silty clay loam or loam. In places the entire profile has been removed. A few large areas consist of mined material or spoil from gravel pits and sand pits and limestone quarries.

Permeability is variable in this map unit depending on the texture and density of the soil material. The soils range from moderate to low in available water capacity. Content of organic matter is very low unless topsoil has been redistributed over the area.

Most areas of this unit are vegetated with grass and remain idle. Smoothed areas are easy to vegetate, but in some areas where vertical cuts have been made, erosion is a severe hazard.

This map unit is not assigned to a capability subclass.

prime farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high quality farmland is limited and the U.S. Department

Figure 14.—One of several limestone quarries in Johnson County. This quarry is in the Devonian system.

of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have the quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when treated and managed using acceptable farming methods. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may now be in use as cropland, pasture, woodland, or they may be used for other purposes. They are used either for producing food or fiber or are available for these uses. Urban or built-up land or water areas are not considered prime farmland.

Prime farmland soils usually have an adequate and dependable supply of moisture from precipitation or irrigation. They have favorable temperature and growing season and acceptable acidity or alkalinity. They have few or no rocks and are permeable to water and air. Prime farmland soils are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

About 204,000 acres, or nearly 52 percent of Johnson County, is prime farmland. Areas are throughout the county. Approximately 200,000 acres is used for crops. Crops grown are mainly corn and soybeans. These crops account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the conversion of some prime farmland soils to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate than prime farmland.

The soil map units that make up prime farmland in Johnson County are listed in this section. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed soil map units." This list does not constitute a recommendation for a particular land use.

Soils that have a high water table, are subject to flooding, or are droughty may qualify for prime farmland soils if these limitations are overcome by drainage, flood control, or irrigation. In the following list, the measures used to overcome the limitation are shown by a footnote after the map unit name. Onsite evaluation is necessary to determine whether the corrective measures have been effective.

430	Ackmore silt loam, 0 to 2 percent slopes [1] [2]
422	Amana silt loam, 0 to 2 percent slopes
760	Ansgar silt loam, 0 to 3 percent slopes [2]
320	Arenzville silt loam, 0 to 2 percent slopes [1]
291	Atterberry silt loam, 0 to 2 percent slopes [2]
1291	Atterberry silt loam, benches, 0 to 2 percent slopes [2]
291B	Atterberry silt loam, 2 to 5 percent slopes [2]
171B	Bassett silt loam, 2 to 5 percent slopes
793	Bertrand silt loam, 1 to 3 percent slopes
174B	Bolan loam, 2 to 5 percent slopes
974B	Bolan loam, loamy substratum, 2 to 5 percent slopes
43	Bremer silty clay loam, 0 to 2 percent slopes [2]
80B	Clinton silt loam, 2 to 5 percent slopes
135	Coland silty clay loam, 0 to 2 percent slopes [2]
133	Colo silty clay loam, 0 to 2 percent slopes [1]
133+	Colo silt loam, overwash, 0 to 2 percent slopes [1]
11B	Colo-Ely complex, 2 to 5 percent slopes [2]
520	Coppock silt loam, 0 to 2 percent slopes [2]
175	Dickinson fine sandy loam, 0 to 2 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
377B	Dinsdale silty clay loam, 2 to 5 percent slopes
162B	Downs silt loam, 2 to 5 percent slopes
962	Elvira silty clay loam, 0 to 2 percent slopes [1] [2]
428B	Ely silt loam, 2 to 5 percent slopes
163B	Fayette silt loam, 2 to 5 percent slopes
118	Garwin silty clay loam, 0 to 2 percent slopes [2]
75	Givin silt loam, 0 to 2 percent slopes [2]
173	Hoopeston fine sandy loam, 0 to 2 percent slopes
83B	Kenyon loam, 2 to 5 percent slopes
184	Klinger silty clay loam, 1 to 3 percent slopes
688	Koszta silt loam, 0 to 2 percent slopes [2]
76B	Ladoga silt loam, 2 to 5 percent slopes
876B	Ladoga silt loam, benches, 2 to 5 percent slopes
110B	Lamont fine sandy loam, 2 to 5 percent slopes
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
484	Lawson silt loam, 0 to 2 percent slopes
280	Mahaska silty clay loam, 0 to 2 percent slopes
1280	Mahaska silty clay loam, benches, 0 to 2 percent slopes
152	Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes [2]
382	Maxfield silty clay loam, 0 to 2 percent slopes [2]
119	Muscatine silt loam, 0 to 2 percent slopes
1119	Muscatine silt loam, benches, 0 to 2 percent slopes
119B	Muscatine silt loam, 2 to 5 percent slopes
88	Nevin silt loam, 0 to 2 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
729B	Nodaway-Arenzville silt loams, 1 to 4 percent slopes [1]
281B	Otley silty clay loam, 2 to 5 percent slopes
976	Raddle silt loam, 1 to 3 percent slopes
826	Rowley silt loam, 0 to 2 percent slopes
778	Sattre silt loam, 0 to 2 percent slopes
778B	Sattre loam, 2 to 5 percent slopes
122	Sperry silt loam, 0 to 1 percent slopes [2]
485	Spillville loam, 0 to 2 percent slopes
165	Stronghurst silt loam, 0 to 2 percent slopes [2]
279	Taintor silty clay loam, 0 to 2 percent slopes [2]
920	Tama silt loam, sandy substratum, 0 to 2 percent slopes
120B	Tama silt loam, 2 to 5 percent slopes

420B	Tama silt loam, benches, 2 to 5 percent slopes
920B	Tama silt loam, sandy substratum, 2 to 5 percent slopes
442B	Tama-Dickinson complex, 2 to 5 percent slopes
453	Tuskeego silt loam, 0 to 2 percent slopes [2]
727	Udolpho loam, 0 to 2 percent slopes [2]
160	Walford silt loam, 0 to 1 percent slopes [2]
1160	Walford silt loam, benches, 0 to 1 percent slopes [2]
161	Walford-Atterberry silt loams, 1 to 3 percent slopes [2]
687	Watkins silt loam, 0 to 2 percent slopes
687B	Watkins silt loam, 2 to 5 percent slopes
771B	Waubeek silt loam, 2 to 5 percent slopes
178	Waukee loam, 0 to 2 percent slopes
350B	Waukegan silt loam, 1 to 5 percent slopes
352B	Whittier silt loam, 2 to 5 percent slopes
7	Wiota silt loam, 1 to 3 percent slopes
54	Zook silty clay loam, 0 to 2 percent slopes [2]

[1] Prime farmland soils where protected from flooding.
[2] Prime farmland soils where drained.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Larry Heaton, district conservationist, Soil Conservation Service, prepared this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1976, according to the 1977 Iowa Agriculture Statistics, about 344,000 acres in Johnson County was used for farming. Of this total, approximately 70,000 acres was used for pasture; 189,000 acres for row crops, mainly corn and beans; 24,000 acres for close grown crops, mainly oats; 30,000 acres for hay, and 31,000 acres for other purposes.

Food production could be increased by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

More land is being used each year for urban development. In 1975 about 18,000 acres was in urban, rural-urban, and built up areas. Good land use should be based upon the properties and capabilities of soils. The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General soil map units."

Soil erosion is the major problem on about two-thirds of the cropland and pasture in Johnson County. If the slope is more than 2 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging for many reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is damaging to soils that are shallow over bedrock because root development is restricted. Erosion also reduces productivity on soils that tend to be droughty, for example, the Chelsea, Dickinson, and Lamont soils. If the surface layer is lost, sediment enters streams. By controlling erosion, pollution of streams by sediment can be cut to a minimum, and water quality is improved for municipal use, recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and

hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth for the following crop.

Many slopes are so short, steep, and irregular that contour tillage or terracing is not practical in some areas. On these soils, cropping systems that provide substantial vegetative cover and conservation tillage are required to control erosion.

Examples of major conservation tillage systems include; (1) no-till, slot, or zero tillage--with this system, preparation of the seedbed and planting is completed in one operation. Little or no soil is disturbed except in the immediate area of the planted seed row. A protective cover of crop residue is left on at least 90 percent of the soil surface. (2) Site-plant--with this system as with the no-till system, seedbed preparation and planting are completed in one operation. Tillage in the row is limited to a strip not wider than 1/3 of the total area. A protective cover of crop residue is left on 2/3 of the soil surface. (3) Chisel-disk or rotary tillage--this system loosens the soil over the entire surface and partially incorporates the residue into the soil. Seedbed preparation and planting may be accomplished in one or in separate operations. Conservation tillage is not effective unless enough residue is left on the soil surface after planting to effectively reduce erosion.

Use of the soil for pasture is also an effective means of controlling erosion. Maximum grass and legume production can be achieved by correct soil treatment and proper use of pasture and hay. Proper management practices for established stands include adequate fertilization, weed and brush control, rotational and deferred grazing where full-season grazing systems are used, proper stocking rates, and adequate livestock watering facilities. A severe erosion hazard results if the vegetative cover is destroyed in the process of renovating sloping pastureland and hayland. If cultivated crops are to be grown prior to seeding for pasture, soil losses can be reduced if conservation tillage, contour farming, and grassed waterways are used. In addition, interseeding grasses and legumes into the existing sod eliminates the need for destroying the existing vegetative cover for seedbed preparation.

The use of terraces and diversions reduces the length of the slope and helps control runoff and erosion. These structures are most adaptable and practical on well drained soils that have regular slopes and gently sloping to moderately sloping topography. The gently sloping Downs and Tama soils are very well suited to terracing. Soils that have subsoils of glacial till can be terraced, but care should be taken not to expose the glacial till. If terraces are constructed on the Bassett, Dinsdale, Kenyon, and Waubeek soils, the topsoil should be stockpiled to cover the undesirable, less fertile, glacial till subsoils. A common practice in the county is to stockpile topsoil on all soils where terraces, sediment and water control basins, and similar conservation devices are constructed.

Contouring and stripcropping are also effective erosion control practices. They are best suited to soils that have smooth, uniform slopes, such as the Clinton, Downs, and Tama soils and some areas of the Fayette soils.

Soil blowing is a hazard, especially on sandier soils, such as the Chelsea and Sparta soils. Soil blowing can damage sandy soils in a few hours if winds are strong, and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage practices minimizes damage from soil blowing.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is a management concern in some areas. Some soils are naturally wet and poorly drained. Examples are the Ansgar, Garwin, Maxfield, Sperry, and Walford soils in the uplands. Other poorly drained soils are in waterways and bottom lands. Examples include the Colo and Coland soils. All of these soils are more productive if tiling is installed. Some areas of the Ansgar, Sperry, and Walford soils require a combination of tiling and surface drainage.

Most soils of the uplands are naturally low in fertility, and reaction is mostly naturally acid. The soils on flood plains, such as the Ackmore, Colo, and Spillville soils, are slightly acid or neutral.

The Downs and Fayette soils are examples of upland soils that are naturally acid. These soils require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops that grow well in nearly neutral soils. Available potassium levels are naturally very low in the Downs, Fayette, and Tama soils and most of the other upland soils. Available phosphorus is high in the subsoil of timbered soils, such as the Fayette soils, but is medium in the Downs soils and low in the Tama soils. On all soils additions of lime and fertilizer should be based on results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular, generally high in content of organic matter, and porous.

Most of the soils used for crops in the survey area have a surface layer of silt loam. On some soils, such as the Fayette soils, the content of organic matter is low, and intense rainfall causes a crust to form on the surface. This crust becomes hard when dry and hinders water infiltration. Once the crust forms and reduces infiltration, runoff increases rapidly. Regular additions of

crop residue, manure, and other organic material help improve soil structure and reduce crust formation.

Fall plowing is not a good practice on the light colored, timbered soils because a crust tends to form during winter and spring. In areas where soils are plowed in the fall, many of the soils are nearly as dense and hard at the time of planting as they were before they were plowed. Using a moldboard plow in fall plowing is undesirable on the soils in Johnson County because of the potential hazard of soil blowing or water erosion.

Field crops suited to the soils and climate of the survey area include many crops that are not commonly grown. Corn and soybeans are the most common crops; however, grain sorghum, sunflowers, potatoes, sugar beets, sweet corn, popcorn, pumpkins, sugar cane, canning peas, canning beans, and navy beans can be grown if economic conditions are favorable. Oats is the most common close growing crop; however, rye, barley, buckwheat, wheat, and flax can be grown. In addition, grass seed could be produced from bromegrass, redtop, bluegrass, switchgrass, big bluestem, and indiangrass.

Special crops grown commercially in the survey area are limited. At present apples are the only specialty crop grown, although most of the well drained soils are suitable for orchards and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing special crops can be obtained from the local office of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that

water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, keep snow from blowing off the fields, reduces energy requirements, and provide food and cover for wildlife.

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

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

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

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for

satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

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

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

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

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

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

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite, pheasant, meadowlark, field sparrow, cottontail, and red fox.

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

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

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were

not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally

favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not

favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as high content of calcium carbonate. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

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

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops.

They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*20*). 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. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

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

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

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

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

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

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other 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* (*19*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*20*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Ackmore series

The Ackmore series consists of somewhat poorly drained or poorly drained, moderately permeable soils that formed in silt loam alluvium 20 to 36 inches thick over buried, dark silty clay loam alluvium. These soils are on flood plains and upland drainageways. Native vegetation was mainly prairie grasses. Slopes range from 0 to 2 percent.

Ackmore soils are similar to Arenzville soils and are commonly adjacent to Colo and Ely soils. Arenzville soils have a lighter colored surface layer than Ackmore soils.

Colo and Ely soils have mollic epipedons more than 24 inches thick. They are in positions on the landscape similar to those of the Ackmore soils.

Typical pedon of Ackmore silt loam, 0 to 2 percent slopes, 1,300 feet west and 30 feet north of the southeast corner of sec. 14, T. 79 N., R. 5 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; neutral; abrupt smooth boundary.

C—7 to 27 inches; stratified very dark gray (10YR 3/1) and grayish brown (10YR 5/2) silt loam; weak thin platy structure; friable; neutral; clear smooth boundary.

IIAb—27 to 44 inches; black (10YR 2/1) silty clay loam, weak fine granular structure; friable; neutral; gradual smooth boundary.

IIBb—44 to 60 inches; very dark gray (10YR 3/1) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; firm; neutral.

The A and C horizons range from 20 to 36 inches in thickness. The A horizon ranges from black (10YR 2/1) or very dark brown (10YR 2/2) to very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The Ap horizon and the C horizon are silt loam or, less commonly, silty clay loam. The strata in the C horizon range from black (10YR 2/1) to grayish brown (10YR 5/2). The A and C horizons range from medium acid to neutral.

The IIAb and IIBb horizons range from 26 to 38 percent clay. They range from black (10YR 2/1 or N 2/0) to very dark gray (10YR 3/1 or N 3/0).

Amana series

The Amana series consists of somewhat poorly drained, moderately permeable soils that formed in silty alluvium. These soils are on flood plains that commonly contain remnants of former stream meanders and natural levees. Native vegetation was mainly prairie grasses. Slopes range from 0 to 2 percent.

Amana soils are similar to Lawson soils and are commonly adjacent to Colo, Lawson, Nevin, Nodaway, and Perks soils. Lawson soils have a thicker, dark A horizon than Amana soils. Colo soils are more poorly drained and also have a thicker, dark A horizon. Nevin soils contain more clay. Nodaway soils are stratified and have a thinner A horizon. Perks soils have more sand. Lawson, Nevin, Nodaway, and Perks soils are on landscape positions similar to those of the Amana soils. Colo soils are on lower lying positions on flood plains.

Typical pedon of Amana silt loam, 0 to 2 percent slopes, 1,280 feet west and 150 feet south of the northeast corner of sec. 2, T. 78 N., R. 8 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky and granular structure; friable; neutral; abrupt smooth boundary.

A12—7 to 13 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A13—13 to 19 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular and subangular blocky structure; friable; slightly acid; clear smooth boundary.

B21—19 to 26 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine subangular blocky structure; friable; thin discontinuous very dark gray (10YR 3/1) silt coatings on faces of peds; few fine faint strong brown (7.5YR 5/8) oxides; medium acid; clear smooth boundary.

B22—26 to 34 inches; dark grayish brown (10YR 4/2) silt loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; few very dark gray (10YR 3/1) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B3—34 to 44 inches; grayish brown (2.5Y 5/2) silt loam; common fine faint yellowish brown (10YR 5/6 and 5/8) mottles; weak coarse prismatic structure; friable; many dark iron and manganese concretions; medium acid; gradual smooth boundary.

C—44 to 60 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) silt loam; many common distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; many dark iron and manganese concretions; medium acid.

The solum ranges from about 30 to 65 inches in thickness and in most places is more than 40 inches. Stratification is weak or absent to a depth of 40 inches, but a few thin lenses of sandy loam or loam are below this depth in some pedons.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). It is silt loam or silty clay loam that is about 18 to 30 percent clay. The B horizon is dark grayish brown (10YR or 2.5Y 4/2) or grayish brown (10YR or 2.5Y 5/2). Mottles that have value of 4 or 5 and chroma of 4 through 8 are typical throughout the B horizon. The B horizon is silt loam or silty clay loam that is about 18 to 30 percent clay.

The C horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. The B and C horizons are medium acid to strongly acid.

Ansgar series

The Ansgar series consists of poorly drained, moderately permeable soils that formed in 24 to 40 inches of loess and underlying glacial till. These soils are flat or in depressions on upland divides or in shallow

drainageways. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 3 percent.

Ansgar soils are similar to Franklin soils and are commonly adjacent to Franklin, Klinger, and Maxfield soils. Maxfield soils have a thicker, dark A horizon than Ansgar soils and do not have an A2 horizon. Klinger soils are better drained and do not have an A2 horizon. Franklin soils are better drained. Dinsdale, Franklin, and Klinger soils are on slopes above the Ansgar soils. Maxfield soils are in positions on the landscape similar to those of the Ansgar soils.

Typical pedon of Ansgar silt loam, 0 to 3 percent slopes, 1,500 feet west and 544 feet south of the northeast corner of sec. 6, T. 81 N., R. 7 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 15 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few fine distinct brown (7.5YR 4/4) mottles; weak thin platy structure; friable; strongly acid; abrupt smooth boundary.

B1t—15 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; thin discontinuous clay films; strongly acid; clear smooth boundary.

B21t—22 to 32 inches; dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; friable; few thin discontinuous clay films; few dark iron and manganese concretions; few fine roots; strongly acid; clear smooth boundary.

B22t—32 to 39 inches; grayish brown (2.5Y 5/2) silty clay loam; few coarse distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium prismatic structure; friable; thin discontinuous clay films; few dark iron and manganese concretions; few fine roots; strongly acid; abrupt smooth boundary.

IIB31—39 to 45 inches; grayish brown (2.5Y 5/2) sandy clay loam; many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; strongly acid; clear smooth boundary.

IIB32—45 to 58 inches; mottled yellowish brown (10YR 5/6 and 5/8) and light gray (10YR 6/1) loam; moderate medium prismatic structure; firm; medium acid; gradual smooth boundary.

IIC—58 to 60 inches; yellowish brown (10YR 5/8) loam; moderate medium prismatic structure; firm; medium acid.

The solum typically is more than 48 inches thick but ranges from 40 to 80 inches in thickness. The loess typically is 24 to 40 inches thick but ranges to 48 inches in thickness.

The Ap horizon is very dark gray (10YR 3/1) or black (10YR 2/1). It is 6 to 9 inches thick. The A2 horizon typically has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is 4 to 8 inches thick.

The upper part of the B horizon has hue of 2.5Y, 10YR, or 5Y, value of 4 or 5, and chroma of 1 or 2, but mottles have higher chroma and may have hue of 7.5YR. The upper part of the B horizon is silty clay loam that ranges from 27 to 35 percent in content of clay. In many places a stone line or a thin lens of sandy material at a depth of 24 to 48 inches separates the silty upper part of the B horizon from the loamy lower part. The IIB horizons have hue of 2.5Y, 10YR, or 5Y, value of 5 or 6, and chroma of 1 or 2, but mottles have higher chroma and may have hue of 7.5YR. The lower part of the B horizon typically is loam but ranges to clay loam or sandy clay loam. Reaction of the B horizon is medium acid to strongly acid.

Arenzville series

The Arenzville series consists of moderately well drained, moderately permeable soils that formed in silty alluvium 20 to 40 inches thick overlying an older, buried soil. These soils are on flood plains and along upland drainageways. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Arenzville soils are similar to Ackmore and Nodaway soils and are commonly adjacent to Nodaway soils. Ackmore soils have a darker surface layer. Nodaway soils do not have a buried soil at a depth of less than 40 inches. Ackmore and Nodaway soils are in positions on the landscape similar to those of the Arenzville soils.

Typical pedon of Arenzville silt loam, from an area of Nodaway-Arenzville silt loams, 1 to 4 percent slopes, 1,480 feet west and 880 feet south of the northeast corner of sec. 12, T. 80 N., R. 6 W.

A1—0 to 11 inches; dark grayish brown (10 YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; thin light gray (10YR 7/2), yellowish brown (10YR 5/4), and brown (10YR 4/3) strata; friable; neutral; clear smooth boundary.

C—11 to 33 inches; dark gray (10YR 4/1), dark grayish brown (10YR 4/2), and brown (10YR 5/3), stratified silt loam; weak medium platy strata resulting from geologic depositions; friable; common dark iron concretions; neutral; abrupt wavy boundary.

IIA11b—33 to 41 inches; black (10YR 2/1) silt loam; few fine prominent reddish brown (5YR 4/4) mottles; weak fine granular structure; friable; neutral; clear smooth boundary.

IIA12b—41 to 54 inches; black (10YR 2/1) silty clay loam; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

IIB1b—54 to 60 inches; very dark gray (10YR 3/1) silty clay loam; few fine prominent grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; neutral.

Depth to the IIAb horizon ranges from 20 to 40 inches. The A1 or Ap horizon typically is dark grayish brown (10YR 4/2), but the strata are variable.

The C horizon is generally stratified, variable in color, and in some places is mottled with chroma of more than 2 in the lower part. Some A and C horizons have thin strata of sand dispersed throughout the silt loam. The buried soil is silty clay loam or silt loam.

Armstrong series

The Armstrong series consists of moderately well drained or somewhat poorly drained, slowly permeable soils. These soils formed in fine textured and moderately fine textured glacial till on uplands. Native vegetation was prairie grasses and deciduous trees. Slopes range from 9 to 14 percent.

Armstrong soils are similar to Gara and Lindley soils and are commonly adjacent to Downs, Gara, Ladoga, and Lindley soils. Gara and Lindley soils do not have the reddish hue of Armstrong soils, and they have less clay in the B2 horizon. Downs and Ladoga soils formed in loess that is high in content of silt and low in content of sand. Gara and Lindley soils are on side slopes below the Armstrong soils. Downs and Ladoga soils are on ridges and side slopes above the Armstrong soils.

Typical pedon of Armstrong loam, 9 to 14 percent slopes, moderately eroded, 120 feet east and 254 feet north of the southwest corner of sec. 27, T. 78 N., R. 7 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; mixed with some streaks and lumps of dark yellowish brown (10YR 4/4); weak fine granular structure; friable; medium acid; abrupt smooth boundary.

B1—7 to 11 inches; dark yellowish brown (10YR 4/4) loam with some mixing of very dark grayish brown (10YR 3/2) and brown (7.5YR 4/4); weak fine granular and subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; clear smooth boundary.

B21t—11 to 16 inches; brown (10YR 4/4) clay loam; few fine faint reddish brown (5YR 4/4) mottles; moderate fine subangular blocky structure; firm; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; thin discontinuous clay films; discontinuous stone line at a depth of 16 inches; strongly acid; clear smooth boundary.

IIB22t—16 to 24 inches; mottled brown (7.5YR 4/4) and dark grayish brown (10YR 4/2) clay; few fine prominent red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; firm; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; some pebbles; very strongly acid; gradual smooth boundary.

IIB23t—24 to 30 inches; mottled brown (7.5YR 4/4), yellowish brown (10YR 5/4), and dark grayish brown (10YR 4/2) clay; few fine prominent red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; firm; thin discontinuous clay films; few pebbles; very strongly acid; gradual smooth boundary.

IIB24t—30 to 38 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) clay loam; few fine prominent red (2.5YR 4/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous clay films; numerous dark iron and manganese concretions; strongly acid; gradual smooth boundary.

IIB31t—38 to 47 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) clay loam; few fine prominent red (2.5YR 4/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous clay films; many dark iron and manganese concretions; strongly acid; gradual smooth boundary.

IIB32t—47 to 60 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) clay loam; weak coarse prismatic structure; firm; thin discontinuous light gray (10YR 7/2) coatings on faces of peds; many dark iron and manganese concretions; medium acid.

The solum ranges from 42 to over 80 inches in thickness.

The A1 or Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It typically is silt loam or loam but ranges to silty clay loam or clay loam. The A2 horizon, where present, is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2) loam or silt loam.

The IIB2t horizon is 12 to 30 inches thick and is 36 to 48 percent clay. The stone or pebble band is above the clay maximum. The IIB2 horizon centers on hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 through 6.

The IIB3 and IIC horizons have hue of 10YR, value of 4 to 5, and chroma of 3 to 6. They are clay loam and range from 30 to 36 percent clay.

Atterberry series

The Atterberry series consists of somewhat poorly drained, moderately permeable soils that formed in loess more than 40 inches thick. These soils are on upland divides, at heads of drainageways, at the base of slopes, and on loess-covered benches along major streams. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 5 percent.

Atterberry soils are similar to Givin, Stronghurst, and Walford soils and are commonly adjacent to Downs, Garwin, Sperry, Tama, and Walford soils. Givin soils have more clay in the subsoil than Atterberry soils. Stronghurst soils have a lighter colored A1 horizon and a thicker, more distinct A2 horizon. Downs and Tama soils have a browner B horizon, are better drained, and are on convex slopes above the Atterberry soils. Garwin and Walford soils are more poorly drained and are generally in a lower position on the landscape. Sperry soils are poorly drained soils and are in depressions.

Typical pedon of Atterberry silt loam, 0 to 2 percent slopes, 660 feet north and 60 feet west of the southeast corner of sec. 2, T. 80 N., R. 5 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak fine granular; friable; strongly acid; clear smooth boundary.

B1t—12 to 16 inches; brown (10YR 4/3) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2) silt coatings on faces of peds; strongly acid; clear smooth boundary.

B21t—16 to 24 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films; few discontinuous light gray (10YR 7/2) silt coatings on faces of peds; medium acid; clear smooth boundary.

B22t—24 to 32 inches; gray (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; thin discontinuous clay films; nearly continuous light gray (10YR 7/2) silt coatings on faces of peds; numerous dark iron concretions; medium acid; gradual smooth boundary.

B31t—32 to 41 inches; light brownish gray (2.5Y 6/2) silty clay loam; grayish brown (2.5Y 5/2) coatings on faces of peds; common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak coarse prismatic structure; friable; thin discontinuous clay films; nearly continuous light gray (10YR 7/2) silt coatings on faces of peds; numerous dark iron and manganese concretions; medium acid; gradual smooth boundary.

B32t—41 to 51 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak coarse prismatic structure; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) silt coatings on faces of peds; numerous dark iron and manganese concretions; medium acid; gradual smooth boundary.

C—51 to 60 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6 and 5/8) silt loam; massive; friable; few dark iron and manganese concretions; slightly acid.

The solum ranges from 40 to 60 inches or more in thickness.

The A1 or Ap horizon ranges from 6 to 10 inches in thickness. It is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The A2 horizon is 3 to 8 inches thick. The A horizons are silt loam that ranges from 20 to 26 percent in content of clay.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. Clay content of the B2 horizon ranges from about 29 to 35 percent. Reaction is medium acid to strongly acid. The B3 horizon generally has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2 with mottles of higher chroma. It is silt loam or silty clay loam that ranges from 25 to 30 percent in content of clay.

Bassett series

The Bassett series consists of moderately well drained, moderately permeable soils that formed in 14 to 26 inches of loamy material and underlying glacial till. These soils are on ridgetops and side slopes on uplands. Native vegetation was prairie grasses and deciduous trees. Slopes range from 2 to 14 percent.

Bassett soils are commonly adjacent to Kenyon and Waubeek soils. Kenyon soils have a thicker, darker A horizon than Bassett soils. Waubeek soils formed in loess and glacial till. They are in positions on the landscape similar to those of the Bassett soils.

Typical pedon of Bassett loam, 2 to 5 percent slopes, 180 feet south and 2,540 feet east of the northwest corner of sec. 8, T. 81 N., R. 7 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; some mixing of brown (10YR 4/3); medium acid; abrupt smooth boundary.

A2—8 to 10 inches; brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure parting to weak fine subangular blocky; friable; medium acid; clear wavy boundary.

B1—10 to 18 inches; brown (10YR 4/3) loam; dark brown (10YR 3/3) coatings on faces of peds; weak fine and medium subangular blocky structure; friable; very dark gray (10YR 3/1) wormcasts; few roots; medium acid; clear smooth boundary.

IIB21t—18 to 23 inches; yellowish brown (10YR 5/4 and 5/6) loam; moderate medium subangular blocky structure; friable; thin discontinuous clay films; few discontinuous silt and sand coatings on faces of peds; few dark iron concretions; strongly acid; gradual smooth boundary.

IIB22t—23 to 30 inches; yellowish brown (10YR 5/4 and 5/6) loam; weak fine prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films; few discontinuous very pale brown (10YR 7/3) dry silt coatings on faces of peds; few fine distinct dark iron concretions; strongly acid; gradual smooth boundary.

IIB31t—30 to 36 inches; yellowish brown (10YR 5/6) loam; few fine faint grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; moderate medium prismatic structure; firm; thin discontinuous clay films; very pale brown (10YR 7/3) dry silt coatings on faces of peds; few fine faint dark iron concretions; strongly acid; gradual smooth boundary.

IIB32t—36 to 52 inches; yellowish brown (10YR 5/6 and 5/8) loam; few fine prominent brown (7.5YR 4/4) and few fine faint grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; moderate coarse prismatic structure; firm; thin discontinuous clay films; thick very dark gray (10YR 3/1) clay flows in root channels; strongly acid; abrupt wavy boundary.

IIC—52 to 60 inches; yellowish brown (10YR 5/6 and 5/8) loam; few fine prominent brown (7.5YR 4/4) and few fine faint grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; massive; firm; dark gray (10YR 4/1) clay flows in root channels; strong effervescence; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to glacial till ranges from about 14 to 26 inches in uneroded areas.

In uncultivated areas, the A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and ranges from 6 to 8 inches in thickness. The A2 horizon, where present, is brown (10YR 4/3 or 10YR 5/3) and ranges from 2 to 6 inches in thickness.

The upper part of the B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or higher. It does not have distinct mottles of lower chroma. Depth to low chroma mottles ranges from 24 to about 36 inches. The IIB horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or higher. It has mottles of lower chroma. The finest texture in the B horizon typically is loam, but in places it is clay loam or sandy clay loam. Reaction ranges from strongly acid to very strongly acid in the B horizon. In many pedons a stone line is in the upper part of the B horizon at a depth ranging from about 14 inches to 26 inches. This layer is commonly gravelly sandy loam.

Bertrand series

The Bertrand series consists of well drained, moderately permeable soils that formed in silty alluvium. These soils are on benches along the major streams in the county. Native vegetation was deciduous trees. Slopes range from 1 to 3 percent.

Bertrand soils are commonly adjacent to Koszta and Nodaway soils. Koszta soils are somewhat poorly drained, have more clay in the B horizon, and are on the lower lying areas on benches. Nodaway soils are moderately well drained, stratified, and on first bottoms.

Typical pedon of Bertrand silt loam, 1 to 3 percent slopes, 1,900 feet north and 60 feet west of the southeast corner of sec. 1, T. 79 N., R. 7 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; medium acid; clear smooth boundary.

A2—5 to 8 inches; brown (10YR 4/3) silt loam with dark gray (10YR 4/1) coatings on faces of peds; weak medium platy structure parting to weak fine granular structure; friable; medium acid; clear smooth boundary.

B1t—8 to 14 inches; dark yellowish brown (10YR 4/4) silt loam; brown (10YR 4/3) coatings on faces of peds; weak fine granular and subangular blocky structure; friable; thin discontinuous clay films; medium acid; gradual smooth boundary.

B21t—14 to 21 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; thin discontinuous clay films; strongly acid; clear smooth boundary.

B22t—21 to 26 inches; yellowish brown (10YR 5/4) silt loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; weak fine and medium subangular blocky structure; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; clear wavy boundary.

B23t—26 to 35 inches; yellowish brown (10YR 5/6) silt loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium subangular blocky structure; friable; thin discontinuous clay films; thin nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual wavy boundary.

B31t—35 to 47 inches; yellowish brown (10YR 5/6) silt loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate coarse subangular blocky structure; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual wavy boundary.

IIB32—47 to 60 inches; yellowish brown (10YR 5/6) loamy sand; weak coarse subangular blocky structure; very friable; few pale brown (10YR 6/3) sand grains; layer of sandy loam at a depth of 58 to 60 inches; strongly acid.

The solum thickness typically is 50 to 60 inches but ranges from 45 to 65 inches.

The A1 or Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The B1 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The control section ranges from 20 to 30 percent clay. In some pedons there is a C horizon.

Bolan series

The Bolan series consists of well drained soils on upland ridges and side slopes and on stream benches. Permeability is moderate to rapid. These soils formed in loamy material overlying sand. Native vegetation was prairie grasses. Slopes range from 2 to 5 percent.

Bolan soils are similar to Dickinson soils and are commonly adjacent to Dickinson, Hayfield, and Sparta soils. Dickinson soils have more sand and less clay in the A horizon and upper part of the B horizon than the Bolan soils. Hayfield soils are more poorly drained. Sparta soils have more sand in the A and B horizons. Dickinson and Sparta soils are in positions on the landscape similar to those of the Bolan soils. Hayfield soils are on concave slopes below the Bolan soils.

Typical pedon of Bolan loam, 2 to 5 percent slopes, 460 feet east and 2,340 feet south of the northwest corner of sec. 8, T. 80 N., R. 7 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; weak fine granular structure; friable; medium acid; clear smooth boundary.

A12—8 to 13 inches; very dark brown (10YR 2/2) loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; weak fine granular structure; friable; medium acid; gradual smooth boundary.

A3—13 to 20 inches; very dark grayish brown (10YR 3/2) loam, gray (10YR 5/1) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B2—20 to 27 inches; brown (10YR 4/3) loam; dark brown (10YR 3/3) coatings on faces of peds; weak very fine and fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B3—27 to 36 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; very friable; medium acid; clear smooth boundary.

IIC1—36 to 55 inches; yellowish brown (10YR 5/4 and 5/6) sand, very pale brown (10YR 7/3) dry; single grain; loose; strong brown (7.5YR 5/6) iron bands at a depth of 50 inches; medium acid; clear smooth boundary.

IIC2—55 to 60 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; medium acid.

The thickness of the solum ranges from 30 to 48 inches. Thickness of the mollic epipedon ranges from 12 to 20 inches.

The Ap or A1 horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2) loam. The B horizon is dark brown (10YR 3/3) or brown (10YR 4/3) and grades to yellowish brown (10YR 5/4 and 5/6) in the lower part.

The C horizon ranges from loamy sand to medium sand, and reaction ranges from neutral to medium acid.

Bremer series

The Bremer series consists of poorly drained soils on low stream benches or high second bottom lands. Permeability is moderately slow. These soils formed in silty alluvium. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Bremer soils are commonly adjacent to Colo, Nevin, Rowley, and Zook soils. Nevin and Rowley soils are better drained than Bremer soils and are on higher lying areas on stream benches. Zook soils are on low flood plains and have a dark A horizon more than 36 inches thick.

Typical pedon of Bremer silty clay loam, 0 to 2 percent slopes, 1,320 feet north and 120 feet east of the southwest corner of sec. 29, T. 77 N., R. 5 W.

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

A12—7 to 18 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular and subangular blocky structure; friable; slightly acid; gradual smooth boundary.

B21t—18 to 23 inches; very dark gray (N 3/0) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; thin continuous clay films; slightly acid; gradual smooth boundary.

B22t—23 to 28 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark gray (10YR 3/1) coatings on faces of peds; few fine distinct olive gray (5Y 5/2) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous clay films; slightly acid; gradual smooth boundary.

B3t—28 to 37 inches; gray (5Y 5/1) silty clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films; common dark iron and manganese concretions; slightly acid; gradual smooth boundary.

C—37 to 60 inches; gray (5Y 5/1) silty clay loam; massive; firm; many dark iron and manganese concretions; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. Reaction typically is slightly acid throughout; however, in some pedons reaction is medium acid in the A horizon or in horizons that have value of 3.

The A horizon is black (10YR 2/1) or very dark gray (N 3/0). The upper part of the B horizon commonly has value of 3, but value increases to 4 or 5 as depth increases. It has hue of 10YR, 2.5Y, or 5Y. The B horizon typically is silty clay loam, but pedons having silty clay subhorizons in the B2t horizon are within the range of the series.

The C horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1.

Burkhardt series

The Burkhardt series consists of somewhat excessively drained, rapidly permeable soils on stream benches and on ridges and side slopes in uplands. These soils formed in 10 to 24 inches of sandy loam material underlain by sand and gravel. Native vegetation was prairie grasses. Slopes range from 2 to 9 percent.

Burkhardt soils are similar to Flagler soils and are commonly adjacent to Dinsdale, Kenyon, and Waukegan soils. Flagler soils have thicker sola and are sandy loam to a depth of 24 inches or more. Dinsdale soils are well drained and moderately well drained and have silty A and B horizons. Kenyon soils are well drained and moderately well drained and have less sand in the A and B horizons than Burkhardt soils. Waukegan soils have silty A and B horizons. Flagler and Waukegan soils are in positions on the landscape similar to those of the Burkhardt soils on stream benches. Dinsdale and Kenyon soils are in convex positions on ridges and side slopes in uplands.

Typical pedon of Burkhardt sandy loam, 5 to 9 percent slopes, 1,220 feet east and 950 feet south of the center of sec. 1, T. 81 N., R. 8 W.

Ap—0 to 6 inches; very dark brown (10YR 2/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few small pebbles; neutral; abrupt smooth boundary.

A12—6 to 10 inches; very dark brown (10YR 2/2) sandy loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; weak fine granular and subangular blocky structure; friable; neutral; clear smooth boundary.

A13—10 to 13 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B2t—13 to 20 inches; dark brown (7.5YR 3/4) sandy loam; weak medium subangular blocky structure; very friable; thin discontinuous clay films; about 20 percent fine gravel; slightly acid; clear smooth boundary.

IIC1—20 to 33 inches; brown (7.5YR 4/4) gravelly loamy sand; single grain; loose; medium acid; gradual wavy boundary.

IIC2—33 to 60 inches; yellowish brown (10YR 5/6) medium and fine sand that is 20 percent gravel; single grain; loose; brown (7.5YR 4/4), 1/4-inch iron bands at a depth of 42 to 54 inches; medium acid.

The solum thickness typically is 16 to 20 inches but ranges from 12 to 24 inches.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The B2 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. It is sandy loam or loam ranging from 8 to 18 percent clay and more than 55 percent sand. A few clay films or clay bridgings are in this horizon. The B2 horizon ranges from slightly acid to strongly acid.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 through 6. It is sand or gravelly sand and ranges from medium acid to slightly acid. Content of gravel ranges from 15 to 40 percent.

Chelsea series

The Chelsea series consists of excessively drained, rapidly permeable soils that formed in sand deposited dominantly by wind. These soils are on stream benches and in uplands. Native vegetation was deciduous trees. Slopes range from 2 to 40 percent.

Chelsea soils are similar to Sparta soils and are commonly adjacent to Fayette and Lamont soils. Sparta soils have a thicker, darker A horizon than Chelsea soils. Fayette soils formed in loess more than 40 inches thick.

Lamont soils have less sand in the A and B horizons. Sparta, Fayette, and Lamont soils are in positions on the landscape similar to those of the Chelsea soils.

Typical pedon of Chelsea loamy fine sand, 2 to 5 percent slopes, 1,320 feet east and 25 feet north of the southwest corner of sec. 1, T. 81 N., R. 5 W.

A11—0 to 1 inch; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; very weak fine granular structure; very friable; much decomposed leaf litter and many fine roots; medium acid; abrupt smooth boundary.

A12—1 to 5 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; single grain; loose; strongly acid; clear smooth boundary.

A21—5 to 9 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) fine sand; single grain; loose; strongly acid; gradual smooth boundary.

A22—9 to 15 inches; brown (10YR 4/3) fine sand; single grain; loose; strongly acid; gradual smooth boundary.

A23—15 to 41 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) fine sand; single grain; loose; strongly acid; gradual smooth boundary.

A&B—41 to 60 inches; yellowish brown (10YR 5/4) fine sand (A2); single grain; loose; 1-inch bands of brown (7.5YR 4/4) sandy loam (B2t) at depths of 42, 54, and 59 inches; strongly acid.

The solum ranges from 4 feet to many feet in thickness.

In uncultivated areas, the A1 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) and is 3 to 5 inches thick. In cultivated areas, the Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 3/3), or brown (10YR 4/3). The A horizon ranges from loamy fine sand to fine sand.

The A&B horizon has lamellae that vary from 1/4 inch to 2 inches in thickness. It has hue of 7.5YR or 10YR, and value and chroma of 3 or 4. Depth to the uppermost lamella ranges from 3 1/2 to 4 1/2 feet. Reaction in uncultivated areas ranges from strongly acid to medium acid in the A horizon.

Clinton series

The Clinton series consists of moderately well drained soils that formed in loess. Permeability is moderately slow. These soils are on convex positions on ridgetops and side slopes in uplands and on high stream benches. Native vegetation was deciduous trees. Slopes range from 2 to 14 percent.

Clinton soils are similar to Fayette and Ladoga soils and are commonly adjacent to Lindley soils. Fayette soils are well drained and have lower clay content in the B horizon than Clinton soils. Ladoga soils have a thicker, dark surface layer. Lindley soils formed in glacial till and are loam or clay loam. Fayette and Ladoga soils are in positions on the landscape similar to those of the Clinton soils. Lindley soils are on convex side slopes below the Clinton soils.

Typical pedon of Clinton silt loam, 2 to 5 percent slopes, 300 feet east and 400 feet north of the southwest corner of sec. 19, T. 78 N., R. 6 W.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; numerous roots; medium acid; abrupt smooth boundary.

A21—2 to 5 inches; dark grayish brown (10YR 4/2) silt loam; weak thin platy and weak fine granular structure; friable; strongly acid; clear smooth boundary.

A22—5 to 9 inches; brown (10YR 4/3) silt loam; dark grayish brown (10YR 4/2) coatings on faces of peds; weak fine granular structure; friable; strongly acid; clear smooth boundary.

B1—9 to 16 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.

B21t—16 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky and angular blocky structure; firm; thin discontinuous clay films; strongly acid; gradual smooth boundary.

B22t—23 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium subangular and angular blocky; firm; thick continuous clay films; strongly acid; diffuse smooth boundary.

B23t—30 to 40 inches; yellowish brown (10YR 5/4) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; few fine distinct grayish brown (2.5Y 5/2) and strong medium prismatic structure parting to strong medium subangular blocky and angular blocky; friable; thin discontinuous clay films; strongly acid; diffuse smooth boundary.

B3t—40 to 52 inches; yellowish brown (10YR 5/4) silty clay loam; dark brown (10YR 4/3) coatings on faces of peds; few fine distinct grayish brown (2.5Y 5/2) and few fine faint strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky and angular blocky; friable; thin discontinuous clay films; few thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; diffuse smooth boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (2.5Y 5/2) and few fine faint strong brown (7.5YR 5/6) mottles; medium coarse prismatic structure; friable; few dark brown coatings in pores; strongly acid.

The thickness of the solum typically is more than 4 feet but ranges from 3 1/2 to 7 feet. If not eroded the A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) silt loam about 5 inches thick. The A2 horizon is about 6 to 14 inches thick. It is dark grayish brown (10YR 4/2), brown (10YR 4/3), grayish brown (10YR 5/2), or brown (10YR 5/3) silt loam. In areas where the soil is eroded, most of the A2 horizon is mixed with the Ap horizon. The B2t horizon is brown (10YR 4/3 or 5/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4).

The B3 horizon and upper part of the C horizon are brown (10YR 5/3) or yellowish brown (10YR 5/4). The C horizon ranges from silt loam to silty clay loam.

Coland series

The Coland series consists of poorly drained, moderately permeable soils that formed in silty and loamy alluvial deposits. These soils are on flood plains and in upland drainageways. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Coland soils are similar to Colo soils and are commonly adjacent to Lawler and Spillville soils. Colo soils have less sand and more silt than Coland soils. Lawler soils are better drained and have a thinner A horizon. Spillville soils are better drained and have less content of clay. Lawler soils are on benches above the Coland soils. Spillville soils are on higher lying areas on flood plains.

Typical pedon of Coland silty clay loam, 0 to 2 percent slopes, 1,160 feet south and 380 feet west of the northeast corner of sec. 5, T. 80 N., R. 8 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A12—8 to 17 inches; black (N 2/0) clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; gradual smooth boundary.

A13—17 to 24 inches; black (N 2/0) clay loam, dark gray (10YR 4/1) dry; moderate fine granular and subangular blocky structure; friable; neutral; gradual smooth boundary.

A14—24 to 38 inches; black (N 2/0) silty clay loam that has visible sand grains, very dark grayish brown (10YR 3/2) dry; moderate medium prismatic structure parting to weak medium subangular blocky; friable; neutral; gradual smooth boundary.

AC—38 to 43 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; neutral; clear smooth boundary.

C1—43 to 55 inches; gray (5Y 5/1) and olive gray (5Y 5/2) clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; black (N 2/0) clay flows in root channels; neutral; abrupt smooth boundary.

C2—55 to 60 inches; very dark gray (2.5Y 3/1) and dark gray (10YR 4/1) sandy loam; massive; friable; neutral.

The solum ranges from 36 to 48 inches in thickness. Reaction is slightly acid or neutral except for the Ap horizon or upper part of the A1 horizon, which is medium acid in some pedons.

The A horizon is black or very dark gray. It is typically silty clay loam that has moderate content of sand or clay loam. The 10- to 40-inch control section ranges from 27 to 35 percent clay and from 15 and 30 percent fine or coarser sand. The A horizon has hue of 10YR or is neutral, value of 2 or 3, and chroma of 1 or less. The AC horizon or B horizon is black, very dark gray, or dark gray. It is clay loam and ranges from 27 to 35 percent clay and 15 to 30 percent sand.

The C horizon has hue of 2.5Y or 5Y or is neutral, value of 2 through 5, and chroma of 1 or less.

Colo series

The Colo series consists of poorly drained, moderately permeable soils that formed in silty alluvial deposits. These soils are on flood plains and in upland drainageways. Native vegetation was prairie grasses. Slopes range from 0 to 5 percent.

Colo soils are similar to Coland and Zook soils and are commonly adjacent to Ackmore, Bremer, Ely, and Spillville soils. Bremer soils have higher clay content in the B horizon than Colo soils. Coland soils contain more sand. Zook soils have higher clay content. Ackmore soils have 20 to 40 inches of overwash material over buried, dark silty clay loam. Ely soils have a browner B horizon and are better drained. Spillville soils are better drained and contain less clay. Ackmore, Ely, and Spillville soils are on bottom lands at slightly higher elevations than the Colo soils. Bremer soils are on stream benches above the Colo soils.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, 100 feet east and 1,500 feet south of the northwest corner of sec. 12, T. 77 N., R. 5 W.

A11—0 to 12 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to moderate fine granular; friable; neutral; gradual smooth boundary.

A12—12 to 25 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; neutral; gradual smooth boundary.

A13—25 to 34 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; friable; neutral; gradual smooth boundary.
AC—34 to 42 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak medium prismatic structure parting to moderate subangular blocky; firm; neutral; diffuse smooth boundary.
Cg—42 to 60 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct brown (7.5YR 4/4) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; neutral.

The solum ranges from 36 to about 50 inches in thickness.

The A horizon has hue of 10YR or is neutral, value of 2 or 3, and chroma of 0 or 1. Below a depth of 10 inches, the clay content commonly ranges from 30 to 35 percent, but some thin layers are as much as 38 percent clay. Colors that have value of 2 or 3 extend to a depth of 36 inches or more.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5, and chroma of 1 or 2, but few to common mottles of high chroma occur in some places. Reaction is slightly acid or neutral throughout.

Coppock series

The Coppock series consists of somewhat poorly drained or poorly drained, moderately permeable soils that formed in silty alluvium. These soils are on stream benches, foot slopes, and alluvial fans. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Coppock soils are similar to Koszta soils and are commonly adjacent to Ladoga and Lawson soils. Koszta soils have a thinner A2 horizon than the Coppock soils. Ladoga soils are better drained, have a browner B horizon, and are above the Coppock soils in uplands. Lawson soils have a thicker, darker A horizon and are on bottom lands below the Coppock soils.

Typical pedon of Coppock silt loam, 0 to 2 percent slopes, 880 feet west and 190 feet south of the northeast corner of sec. 2, T. 78 N., R. 7 W.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; friable; neutral; clear smooth boundary.
A21—7 to 12 inches; dark grayish brown (10YR 4/2) silt loam; very dark gray (10YR 3/1) coatings on faces of peds; weak thin platy structure parting to weak fine granular; friable; few fine faint brown (7.5YR 4/4) iron stains; slightly acid; clear smooth boundary.
A22—12 to 19 inches; dark grayish brown (10YR 4/2) silt loam; some dark gray (10YR 4/1) coatings on faces of peds; weak thin platy structure parting to weak fine subangular blocky; friable; common fine faint brown (7.5YR 4/4) iron stains; slightly acid; clear smooth boundary.
A23—19 to 24 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure parting to weak fine and medium subangular blocky; friable; few fine faint brown (7.5YR 4/4) iron stains; few dark iron and manganese concretions; medium acid; clear smooth boundary.
B21tg—24 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine and medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; thick continuous clay films; few dark iron and manganese concretions; strongly acid; gradual smooth boundary.
B22tg—32 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine and medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak fine and medium subangular blocky; friable; thick continuous black (2.5Y 2/0) clay flows; common dark iron and manganese concretions; strongly acid; gradual smooth boundary.
B31tg—44 to 50 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine and medium yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; few black (10YR 2/1) clay flows; thin discontinuous clay films; common dark iron and manganese concretions; medium acid; gradual smooth boundary.
B32tg—50 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine and medium yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; friable; few dark grayish brown (2.5Y 4/2) clay flows; common dark iron and manganese concretions; medium acid.

The solum typically ranges from 40 to 70 inches thick. Reaction ranges from medium acid to very strongly acid in the B horizon.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The A2 horizon has hue of 10YR, value of 4 through 6, and commonly chroma of 2. It is silt loam that ranges from 18 to 26 percent content of clay.

The B2tg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. Silt coatings of light brownish gray (10YR 6/2) and light gray (10YR 7/1 or 7/2) when dry are common in the upper part of the B horizon. The B2tg horizon ranges from 27 to 35 percent content of clay. In some pedons horizons of as much as 40 percent clay are at a depth of more than 30 inches.

Dickinson series

The Dickinson series consists of well drained or somewhat excessively drained soils on upland ridges and side slopes and on stream benches. Permeability is moderately rapid to rapid. These soils formed in sandy and loamy material that was dominantly wind deposited. Native vegetation was prairie grasses. Slopes range from 0 to 9 percent.

Dickinson soils are similar to Bolan soils and commonly are adjacent to Bolan, Hoopeston, Kenyon, and Sparta soils. Bolan soils contain less sand in the A and B horizons than Dickinson soils. Hoopeston soils have grayer B horizons. Kenyon soils formed in glacial till and have more clay in the solum. Sparta soils have more sand in the A horizon and upper part of the B horizon. These soils are in positions on the landscape similar to those of the Dickinson soils.

Typical pedon of Dickinson fine sandy loam, 2 to 5 percent slopes, 1,640 feet south and 340 feet west of the northeast corner of sec. 7, T. 80 N., R. 7 W.

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

A12—7 to 10 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A13—10 to 16 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable; neutral; gradual smooth boundary.

B1—16 to 20 inches; mixed very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

B21—20 to 23 inches; brown (10YR 4/3) fine sandy loam; very weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

B22—23 to 30 inches; dark yellowish brown (10YR 4/4) fine sandy loam; very weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

B3—30 to 36 inches; yellowish brown (10YR 5/4) loamy fine sand; very weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

C—36 to 60 inches; yellowish brown (10YR 5/6) sand; single grain; loose; slightly acid.

The solum ranges from 24 to 40 inches in thickness.

The A horizon ranges from black (10YR 2/1) or very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2) and from 10 to 20 inches in thickness. It is fine sandy loam or sandy loam.

The B2 horizon ranges from dark brown (10YR 3/3) to brown (10YR 4/3) in the upper part and from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) in the lower part. Reaction ranges from slightly acid to strongly acid in the B horizon. The B horizon is fine sandy loam or sandy loam in the upper part grading to loamy fine sand or loamy sand in the lower part.

The C horizon ranges from loamy sand to fine and medium sand.

Dinsdale series

The Dinsdale series consists of well drained and moderately well drained, moderately permeable soils that formed in 24 to 40 inches of loess and the underlying glacial till. These soils are on ridgetops and side slopes in uplands. Native vegetation was prairie grasses. Slopes range from 2 to 9 percent.

Dinsdale soils are commonly adjacent to Burkhardt, Kenyon, Klinger, and Maxfield soils. Waubeek soils have a thinner, dark A horizon than the Dinsdale soils. Burkhardt soils are underlain by sand and gravel. Kenyon soils have more sand in the upper part of the profile and are shallower to glacial till. Klinger and Maxfield soils have a grayer B horizon and are more poorly drained. Burkhardt soils are in positions on the landscape similar to those of the Dinsdale soils. Kenyon soils are on side slopes below the Dinsdale soils, and Klinger soils are on ridgetops below the Dinsdale soils. Maxfield soils are in low lying areas below the Dinsdale soils.

Typical pedon of Dinsdale silty clay loam, 2 to 5 percent slopes, 140 feet south and 2,508 feet east of the northwest corner of sec. 11, T. 80 N., R. 7 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A12—7 to 11 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A3—11 to 16 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry, very dark grayish brown (10YR 3/2) crushed; weak fine granular structure; friable; slightly acid; gradual smooth boundary.

B1—16 to 22 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B2t—22 to 27 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few thin discontinuous clay films; medium acid; clear smooth boundary.

B31t—27 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; few thin discontinuous clay films; medium acid; clear smooth boundary.
IIB32t—33 to 44 inches; yellowish brown (10YR 5/6) loam; few fine faint light brownish gray (10YR 6/2) mottles; weak medium prismatic structure; friable; few thin discontinuous clay films; discontinuous band of pebbles at a depth of 33 to 34 inches; medium acid; gradual smooth boundary.
IIC1—44 to 54 inches; yellowish brown (10YR 5/6) loam; few medium distinct light grayish brown (10YR 6/2) mottles; massive; firm; neutral; gradual smooth boundary.
IIC2—54 to 60 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; mildly alkaline.

The solum typically is about 50 inches thick but ranges from 42 to 60 inches in thickness. The loess typically is 24 to 40 inches thick but ranges from 18 to 42 inches in thickness.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2) silt loam or silty clay loam. It ranges from 10 to 20 inches in thickness in uneroded areas.

The upper part of the B horizon is dark brown (10YR 3/3), brown (10YR 4/3), and dark yellowish brown (10YR 4/4), and ranges from about 29 to 34 percent content of clay. The upper part of the B horizon ranges from medium acid to strongly acid. The B3 horizon is typically loam but ranges to sandy clay loam and clay loam. In places a layer of sandy loam or loamy sand as much as 10 inches thick is between the loess and the glacial till. Carbonates are at a depth of about 45 to 65 inches.

The Dinsdale soils in map unit 377C2 are taxadjuncts to the Dinsdale series because the dark surface soil is thinner than is required for a mollic epipedon.

Downs series

The Downs series consists of well drained, moderately permeable soils that formed in loess more than 40 inches thick. These soils are on upland ridges and side slopes and on stream benches. Native vegetation was prairie grasses and deciduous trees. Slopes range from 2 to 14 percent.

Downs soils are similar to Fayette and Ladoga soils and are commonly adjacent to Armstrong, Atterberry, Fayette, and Tama soils. Fayette soils have a thinner, dark A horizon and a more distinct A2 horizon than Downs soils. Ladoga soils have more clay in the B horizon. Armstrong soils formed in a reddish paleosol. Atterberry soils have a grayer B horizon and are not so well drained. Tama soils have a thicker, dark A1 horizon and do not have an A2 horizon. Armstrong soils are on convex slopes below the Downs soils, and Atterberry soils are on concave slopes below the Downs soils. Fayette, Ladoga, and Tama soils are in positions on the landscape similar to those of the Downs soils.

Typical pedon of Downs silt loam, 2 to 5 percent slopes, 67 feet west and 820 feet south of the northeast corner of sec. 1, T. 79 N., R. 6 W.

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; medium acid; abrupt smooth boundary.
B1—7 to 13 inches; brown (10YR 4/3) silty clay loam; dark brown (10YR 3/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; medium acid; gradual smooth boundary.
B21t—13 to 19 inches; dark yellowish brown (10YR 4/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; thin discontinuous clay films; medium acid; gradual smooth boundary.
B22t—19 to 29 inches; yellowish brown (10YR 5/4) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; few thin discontinuous clay films; medium acid; gradual smooth boundary.
B31t—29 to 37 inches; yellowish brown (10YR 5/6) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) silt coatings on faces of peds; few dark iron concretions; medium acid; gradual smooth boundary.
B32t—37 to 54 inches; yellowish brown (10YR 5/6) silt loam; yellowish brown (10YR 5/4) coatings on faces of peds; few fine faint light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) silt coatings on faces of peds; few dark iron concretions; medium acid; gradual smooth boundary.
C—54 to 60 inches; yellowish brown (10YR 5/6) silt loam; yellowish brown (10YR 5/4) coatings on faces of peds; common fine and medium faint light brownish gray (10YR 6/2) mottles; massive; friable; thin discontinuous light gray (10YR 7/2) silt coatings on faces of peds; medium acid.

The solum ranges from 48 to 70 inches in thickness.

Where present the A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The upper part of the B horizon commonly is dark brown (10YR 3/3) or brown (10YR 4/3) and grades to value of 4 or 5 and chroma of 4 to 6 as depth increases. The finest textured part of the

B horizon is silty clay loam. Clay content ranges from 27 to 34 percent. Depth to low chroma mottles typically is more than 35 inches. Reaction is medium acid to very strongly acid.

Elvira series

The Elvira series consists of poorly drained, moderately permeable soils that formed in moderately fine textured alluvial deposits. The Elvira soils are high in free iron. These soils are on flood plains and low lying benches. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Elvira soils are commonly adjacent to Colo, Houghton, and Zook soils. Colo and Zook soils do not have a high concentration of iron and manganese in the solum. They are in positions on the landscape similar to those of the Elvira soils. Houghton soils formed in organic material. They are in depressions below the Elvira soils.

Typical pedon of Elvira silty clay loam, 0 to 2 percent slopes, 2,502 feet east and 1,200 feet north of the southwest corner of sec. 25, T. 79 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; firm; neutral; abrupt smooth boundary.

A12—7 to 17 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; firm; slightly acid; clear wavy boundary.

B1g—17 to 22 inches; very dark gray (10YR 3/1) and black (N 2/0) silty clay loam, gray (10YR 5/1) dry; common fine prominent strong brown (7.5YR 5/6) and yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; firm; slightly acid; clear wavy boundary.

B22g—22 to 28 inches; dark gray (5Y 4/1) silty clay loam; moderate medium subangular blocky structure; firm; common medium soft reddish brown (5Y 4/4) iron and manganese oxides; large black (N 2/0) krotovina; slightly acid; clear irregular boundary.

B23g—28 to 37 inches; dark gray (5Y 4/1) clay loam; moderate medium subangular blocky structure; firm; common medium soft dark reddish brown (5YR 3/4) iron and manganese oxides; slightly acid; clear irregular boundary.

B3g—37 to 46 inches; dark gray (N 4/0) silty clay loam; moderate coarse prismatic structure; firm; common fine soft reddish brown (5YR 4/4) iron and manganese oxides; slightly acid; clear irregular boundary.

C—46 to 60 inches; gray (5Y 6/1) silty clay loam; massive; firm; few fine distinct light olive brown (2.5Y 5/6) mottles; slightly acid.

The solum ranges from 35 to 50 inches in thickness.

The A horizon ranges from 12 to 24 inches thick. It has hue of 10YR or is neutral, value is 2 or 3, and chroma is 0 or 1. Texture is commonly silty clay loam that ranges to silt loam, loam, and clay loam. In places the A horizon has iron and manganese oxides or mottles in hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5, and chroma of 3 to 6. Reaction ranges from neutral to medium acid.

The B horizon has hue of 10YR, 5Y, or 2.5Y, value of 3 or 4, and chroma of 1 or 2. The B2 horizon commonly is silty clay loam that ranges to clay loam. The clay content ranges from 28 to 35 percent. Reaction ranges from slightly acid to medium acid.

The C horizon commonly is silty clay loam or silt loam that ranges to loam and clay loam. Strata of sandy loam or loamy sand are in some pedons. Reaction ranges from neutral to slightly acid.

Ely series

The Ely series consists of somewhat poorly drained, moderately permeable soils that formed in sediment washed from loess covered, adjacent side slopes. These soils are on foot slopes and alluvial fans. Native vegetation was prairie grasses. Slopes range from 2 to 5 percent.

Ely soils are similar to Muscatine soils and are commonly adjacent to Ackmore, Colo, and Lawson soils. Muscatine soils have a thinner A horizon than Ely soils. Ackmore soils have a lighter colored surface layer. Colo soils are poorly drained and have a thicker A horizon. Lawson soils have less content of clay. Ackmore, Colo, and Lawson soils are on bottom lands.

Typical pedon of Ely silt loam, 2 to 5 percent slopes, 1,250 feet north and 41 feet west of the southeast corner of sec. 18, T. 79 N., R. 5 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A12—7 to 18 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry, very dark brown (10YR 2/2) kneaded; weak fine granular structure; friable; neutral; clear smooth boundary.

A3—18 to 26 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; very dark grayish brown (10YR 3/2) kneaded; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

B1—26 to 31 inches; grayish brown (10YR 5/2) silty clay loam; dark grayish brown (10YR 4/2) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; few dark iron and manganese concretions; medium acid; gradual smooth boundary.

B2—31 to 41 inches; grayish brown (10YR 5/2) silty clay loam; dark grayish brown (10YR 4/2) coatings on faces of peds; common fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; medium acid; gradual smooth boundary.
B3—41 to 57 inches; grayish brown (10YR 5/2) silty clay loam; dark grayish brown (10YR 4/2) coatings on faces of peds; common medium distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6 and 5/8) mottles; weak fine prismatic structure; friable; slightly acid; gradual smooth boundary.
C—57 to 60 inches; grayish brown (10YR 5/2) silt loam; common medium distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; neutral.

The solum is generally more than 48 inches thick and ranges from 40 to 66 inches in thickness.

The A horizon is silt loam or silty clay loam. Colors that have value of 3 extend to a depth of between 24 and 36 inches. The B horizon ranges from about 30 to 35 percent clay.

Fayette series

The Fayette series consists of well drained, moderately permeable soils that formed in loess more than 40 inches thick. These soils are mainly on ridges and side slopes in uplands, but small areas are on benches adjacent to the major streams. Native vegetation was deciduous trees. Slopes range from 2 to 40 percent.

Fayette soils are similar to Clinton and Downs soils and are commonly adjacent to Chelsea, Downs, Lindley, and Stronghurst soils. Clinton soils have more clay in the B horizon than Fayette soils. Downs soils have a thicker, dark A horizon and a less distinct A2 horizon. Chelsea soils formed in sandy material. Chelsea and Downs soils are in positions on the landscape similar to those of the Fayette soils. Lindley soils formed in glacial till and are on side slopes below the Fayette soils. Stronghurst soils have a grayer B horizon and are on concave slopes above the Fayette soils.

Typical pedon of Fayette silt loam, 2 to 5 percent slopes, 2,400 feet east and 900 feet north of the southwest corner of sec. 24, T. 80 N., R. 8 W.

AO—1/2 inch to 0; decomposed leaf litter.
A1—0 to 3 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; medium acid; clear smooth boundary.
A21—3 to 5 inches; dark grayish brown (10YR 4/2) silt loam; weak thin platy structure; friable; thin discontinuous light brownish gray (10YR 6/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.
A22—5 to 10 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam; weak thin platy structure; friable; thin discontinuous light brownish gray (10YR 6/2) dry silt coatings on faces of peds; medium acid; clear irregular boundary.
B1—10 to 14 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; thin discontinuous pale brown (10YR 6/3) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.
B21t—14 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine and medium subangular and angular blocky structure; friable; thin discontinuous pale brown (10YR 6/3) dry silt coatings on faces of peds; thin discontinuous clay films; strongly acid; gradual smooth boundary.
B22t—20 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular and angular blocky structure; friable; thin discontinuous pale brown (10YR 6/3) dry silt coatings on faces of peds; thin discontinuous clay films; strongly acid; gradual smooth boundary.
B31t—28 to 38 inches; yellowish brown (10YR 5/4) light silty clay loam; moderate fine and medium subangular and angular blocky structure; friable; few thin light gray (10YR 7/2) dry silt coatings on faces of peds; thin discontinuous clay films; strongly acid; gradual smooth boundary.
B32—38 to 47 inches; yellowish brown (10YR 5/4) light silty clay loam; weak medium prismatic structure parting to moderate medium subangular and angular blocky; friable; few thin light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron concretions; strongly acid; gradual smooth boundary.
C—47 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; with distinct vertical cleavage; friable; strongly acid.

The solum ranges from 45 to 60 inches or more in thickness.

The A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and ranges from 2 to 5 inches in thickness. In cultivated areas the Ap horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 4/3 or 5/3). The A2 horizon typically is dark grayish brown (10YR 4/2) and brown (10YR 4/3) but ranges to grayish brown (10YR 5/2) and brown (10YR 5/3). It ranges from 4 to 8 inches in thickness. The A horizon is silt loam that ranges from 15 to 25 percent content of clay. The B2t horizon has value of 4 or 5 and chroma of 3 or 4. Clay content of the B2t horizon is 30 to 35 percent. Mottles that have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2 are in the lower part of the B horizon and in places in the C horizon. Depth to these mottles generally decreases as slope gradient increases on convex slopes. Reaction is very strongly acid to strongly acid in the B horizon.

The B3 horizon and the C horizon are silt loam or silty clay loam.

Flagler series

The Flagler series consists of somewhat excessively drained soils on stream benches. Permeability is rapid in the upper part of the profile and very rapid in the lower part. These soils formed in stratified, loamy alluvium over sand and gravel. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Flagler soils are similar to Burkhardt soils and are commonly adjacent to Sparta and Waukee soils. Burkhardt soils have more gravel at shallower depths than Flagler soils. Sparta soils have less content of clay in the B horizon and do not have coarser particles. Waukee soils have more clay in the B horizon. Sparta soils are on slopes above the Flagler soils. Waukee soils are on benches at a slightly lower elevation than the Flagler soils.

Typical pedon of Flagler sandy loam, 0 to 2 percent slopes, 1,460 feet west and 100 feet north of the southeast corner of sec. 11, T. 81 N., R. 5 W.

Ap—0 to 7 inches; black (10YR 2/1) sandy loam, gray (10YR 5/1) dry, very dark brown (10YR 2/2) crushed; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; some coarse sand and fine gravel throughout the horizon; slightly acid; clear smooth boundary.

A3—11 to 20 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; very friable; some coarse sand and fine gravel throughout the horizon; slightly acid; gradual smooth boundary.

B2—20 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine and medium subangular blocky structure; very friable; discontinuous clay flows; some coarse sand and fine gravel throughout the horizon; medium acid; abrupt smooth boundary.

B3—28 to 37 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine and medium subangular blocky structure; very friable; some coarse sand and fine gravel throughout the horizon; medium acid; clear wavy boundary.

IIC—37 to 60 inches; stratified yellowish brown (10YR 5/6) and dark brown (7.5YR 4/4) gravelly loamy sand; single grain; loose; 30 percent gravel; medium acid.

The solum ranges from 20 to 50 inches in thickness. The mollic epipedon ranges from 10 to 24 inches in thickness. Depth to sand and gravel ranges from 20 to 37 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) and is sandy loam or fine sandy loam. The B2 and B3 horizons range from brown (10YR 4/3) to yellowish brown (10YR 5/4) and are sandy loam or fine sandy loam. Reaction is slightly acid or medium acid. Sand content of the B horizon typically is 60 to 70 percent.

The IIC horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Gravel content of the IIC horizon ranges from 20 to 50 percent.

Franklin series

The Franklin series consists of somewhat poorly drained, moderately permeable soils that formed in 24 to 40 inches of loess and the underlying glacial till. These soils are on upland divides and in concave positions at the heads of drainageways. Native vegetation was prairie grasses and deciduous trees. Slopes range from 1 to 3 percent.

Franklin soils are similar to Ansgar soils and are commonly adjacent to Ansgar, Kenyon, Maxfield, and Waubeek soils. Ansgar soils have a grayer B horizon than Franklin soils and are poorly drained. They are in drainageways or flats below the Franklin soils. Kenyon soils have a browner B horizon, have more sand throughout the solum, are better drained, and are on convex slopes below the Franklin soils. Maxfield soils are more poorly drained and are in a lower position on the landscape. Waubeek soils have a browner B horizon and are on convex slopes above the Franklin soils.

Typical pedon of Franklin silt loam, 1 to 3 percent slopes, 400 feet west and 90 feet north of the southeast corner of sec. 11, T. 81 N., R. 6 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A2—7 to 14 inches; dark grayish brown (10YR 4/2) silt loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure parting to weak fine granular; friable; few dark iron and manganese concretions; medium acid; clear smooth boundary.

B1—14 to 19 inches; dark grayish brown (10YR 4/2) silt loam; dark brown (10YR 3/3) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few dark iron and manganese concretions; medium acid; clear smooth boundary.

B21t—19 to 25 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films; few dark iron and manganese concretions; strongly acid; clear boundary.

IIB22t—25 to 33 inches; grayish brown (10YR 5/2) loam; common fine faint yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; firm; thin discontinuous clay films; strongly acid; gradual wavy boundary.

IIB3t—33 to 43 inches; yellowish brown (10YR 5/6) loam; common medium faint grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; moderate coarse prismatic structure; firm; thin discontinuous clay films; many dark iron and manganese concretions; strongly acid; gradual smooth boundary.

IIC—43 to 60 inches; yellowish brown (10YR 5/6) loam; common medium faint grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; massive; firm; discontinuous clay films in root channels; many dark iron and manganese concretions; medium acid.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The A2 horizon typically has hue of 10YR, value of 4 or 5, and chroma of 2. It is about 4 to 8 inches thick.

The upper part of the B horizon ranges from dark grayish brown (10YR 4/2 or 2.5Y 4/2) to grayish brown (10YR 5/2) and has mottles of higher chroma. The upper part of the B horizon is silty clay loam that is 30 to 34 percent clay. In most places a stone line or a thin lens of sandy material that is at a depth of 24 to 40 inches separates the silty upper part of the B horizon from the loamy lower part. The IIB horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. Mottles are of lower chroma. The lower part of the B horizon typically is loam but in places is clay loam or sandy clay loam. Reaction in the upper part of the B horizon is very strongly acid to medium acid.

Gara series

The Gara series consists of well drained and moderately well drained soils on uplands. Permeability is moderately slow. These soils formed in loamy glacial till. Native vegetation was prairie grasses and deciduous trees. Slopes range from 9 to 18 percent.

The Gara soils are similar to Armstrong and Lindley soils and are commonly adjacent to Armstrong, Downs, and Ladoga soils. Lindley soils have a thinner A1 horizon than Gara soils, and they have distinct A2 horizons. Armstrong soils formed in a paleosol and are upslope from the Gara soils. Downs and Ladoga soils formed in loess and are on slopes above the Gara and Armstrong soils.

Typical pedon of Gara loam, 14 to 18 percent slopes, moderately eroded, 220 feet east and 250 feet north of the southwest corner of sec. 29, T. 78 N., R. 7 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; mixed with streaks and patches of dark yellowish brown (10YR 4/4) subsoil material; weak fine granular and subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B21t—7 to 15 inches; dark yellowish brown (10YR 4/4) loam; brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; few pebbles; thin discontinuous clay films; slightly acid; clear smooth boundary.

B22t—15 to 24 inches; dark yellowish brown (10YR 4/4) clay loam; brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; firm; few pebbles; few dark iron concretions; thin discontinuous clay films; medium acid; gradual smooth boundary.

B23t—24 to 36 inches; yellowish brown (10YR 5/6) clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; few fine faint grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; firm; few pebbles; few dark iron concretions; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B3t—36 to 48 inches; yellowish brown (10YR 5/6) clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; fine distinct grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm thin discontinuous clay films; few pebbles; many dark iron concretions; slightly acid; gradual smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/6) clay loam, common fine distinct grayish brown (2.5Y 5/2) mottles; massive; firm; few pebbles; many dark iron concretions; neutral.

The solum ranges from 36 to 70 inches in thickness. In many pedons a few pebbles and stones are throughout the profile.

The A1 or Ap horizon is generally very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It typically is loam but in some pedons is silt loam. The B2t horizon ranges from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6). Clay content ranges from 32 to 35 percent, but in some pedons thin layers range to as much as 38 percent clay.

Garwin series

The Garwin series consists of poorly drained, moderately permeable soils that formed in loess more than 40 inches thick. These soils are in concave positions at heads of upland drainageways and on broad, upland flats. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Garwin soils are commonly adjacent to Atterberry, Muscatine, Sperry, and Tama soils. Atterberry and Sperry soils have A2 horizons. Atterberry and Muscatine soils have a thinner, dark A horizon and are not so poorly drained as Garwin soils. Tama soils have browner B horizons and are better drained. Atterberry and Muscatine soils are on ridgetops above the Garwin soils. Sperry soils are in depressions. Tama soils are in convex positions on ridges and side slopes above the Garwin soils.

Typical pedon of Garwin silty clay loam, 0 to 2 percent slopes, 1,200 feet south and 540 feet west of the northeast corner of sec. 34, T. 79 N., R. 5 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A12—8 to 15 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; slightly acid; clear smooth boundary.

A3—15 to 20 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; moderate medium granular structure; friable; slightly acid; gradual smooth boundary.

B1g—20 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam; very dark gray (10YR 3/1) coatings on faces of peds; few fine faint light olive brown (2.5Y 5/4) mottles; moderate fine and medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B21g—26 to 32 inches; olive gray (5Y 5/2) silty clay loam; dark gray (5Y 4/1) coatings on faces of peds; common fine distinct light olive brown (2.5Y 5/4 and 5/6) mottles; moderate medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B22g—32 to 39 inches; olive gray (5Y 5/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; neutral; gradual smooth boundary.

B3g—39 to 48 inches; light olive gray (5Y 6/2) silty loam; few faint distinct light olive brown (2.5Y 5/4) mottles; weak coarse prismatic structure; friable; neutral; gradual smooth boundary.

C—48 to 60 inches; light olive gray (5Y 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; neutral.

The solum ranges from 36 to 50 inches in thickness.

The A1 or Ap horizon is black (N 2/0) to very dark gray (10YR 3/1). The A horizon ranges from 14 to 23 inches in thickness. It is silty clay loam that ranges from 30 to 35 percent content of clay.

The B2g horizon has hue of 5Y or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is silty clay loam that ranges from about 28 to 34 percent content of clay. The B3g horizon is silty clay loam or silt loam.

Givin series

The Givin series consists of somewhat poorly drained soils on broad, upland flats. Permeability is moderately slow. These soils formed in loess. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Givin soils are similar to Atterberry soils and are commonly adjacent to Ladoga and Mahaska soils. Atterberry soils have less clay in the B horizon than Givin soils. Ladoga soils have browner B horizons and are better drained. Mahaska soils have a thicker A horizon and do not have an A2 horizon and grainy coatings in the upper part of the B horizon. Ladoga soils are in convex positions on ridges and side slopes above the Givin soils. Mahaska soils are in positions on the landscape similar to those of the Givin soils.

Typical pedon of Givin silt loam, 0 to 2 percent slopes, 2,450 feet south and 129 feet east of the northwest corner of sec. 30, T. 78 N., R. 6 W.

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; neutral; abrupt smooth boundary.

A2—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; neutral; clear smooth boundary.

B1—11 to 16 inches; dark grayish brown (10YR 4/2) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine angular and subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2) dry and light brownish gray (10YR 6/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B21t—16 to 24 inches; brown (10YR 4/3) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine and medium angular and subangular blocky structure; firm; few discontinuous clay films; nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B22t—24 to 33 inches; grayish brown (10YR 5/2) silty clay loam; dark grayish brown (10YR 4/2) coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular and subangular; firm; thin discontinuous clay films; few discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B23t—33 to 43 inches; mottled yellowish brown (10YR 5/6), grayish brown (2.5Y 5/2), and light brownish gray (2.5Y 6/2) silty clay loam; weak medium prismatic structure; firm; numerous dark iron and manganese concretions; few thin discontinuous clay films; strongly acid; gradual smooth boundary.

B3t—43 to 52 inches; mottled yellowish brown (10YR 5/6), grayish brown (2.5Y 5/2), and light brownish gray (2.5Y 6/2) silty clay loam; weak coarse prismatic structure; firm; thin discontinuous clay films; many dark iron and manganese concretions; strongly acid; gradual smooth boundary.

C—52 to 60 inches; mottled yellowish brown (10YR 5/6), grayish brown (2.5Y 5/2), and light brownish gray (2.5Y 6/2) silty clay loam; massive; firm; many dark iron and manganese concretions; strongly acid.

The thickness of the solum ranges from 48 to 72 inches. The thickness of the mollic epipedon ranges from 6 to 10 inches.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The clay content ranges from 18 to 26 percent. The A2 horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2).

The mottled B2t horizon is dominantly dark grayish brown (10YR 4/2) and ranges in hue from 10YR in the upper part to 2.5Y in the lower part. Value is 4 or 5 and chroma is 2 or 3. The B2t horizon is silty clay loam or silty clay. Clay content ranges from 36 to 42 percent.

The B3 and C horizons have hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 2. Mottles of high chroma and iron accumulations are in parts of the B3 horizon and upper part of the C horizon.

Hoopeston series

The Hoopeston series consists of somewhat poorly drained soils on stream benches and uplands. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. These soils formed in sandy and loamy material that was dominantly wind deposited. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Hoopeston soils are commonly adjacent to Dickinson, Sparta, and Waukee soils. Dickinson soils do not have mottles in the subsoil and are better drained than Hoopeston soils. Sparta soils have less content of clay in the subsoil, do not have mottles, and are better drained. Waukee soils have more clay in the subsoil, do not have motttles, and are better drained. Dickinson, Sparta, and Waukee soils are on higher lying positions than the Hoopeston soils.

Typical pedon of Hoopeston fine sandy loam, 0 to 2 percent slopes, 180 feet south and 1,700 feet east of the northwest corner of sec. 25, T. 78 N., R. 6 W.

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

A3—7 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, gray (10YR 5/1) dry; very dark gray (10YR 3/1) coatings on faces of peds; weak fine granular structure; few dark iron and manganese concretions; medium acid; gradual smooth boundary.

B1—11 to 17 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium prismatic structure parting to weak fine subangular blocky; very friable; few dark iron and manganese concretions; medium acid; gradual smooth boundary.

B2—17 to 35 inches; dark grayish brown (10YR 4/2) sandy loam; many medium prominent brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very friable; few dark iron and manganese concretions; medium acid; gradual smooth boundary.

C1—35 to 48 inches; light brownish gray (10YR 6/2) and pale brown (10YR 6/3) loamy sand; common medium prominent brown (7.5YR 4/4) mottles; single grain; loose; few dark iron and manganese concretions; medium acid; abrupt smooth boundary.

C2—48 to 60 inches; mottled light brownish gray (10YR 6/2), pale brown (10YR 6/3), and brown (7.5YR 4/4) loamy sand; single grain; loose; few dark manganese concretions; medium acid.

The thickness of the solum ranges from 20 to 44 inches. The thickness of the A horizon ranges from 10 to 20 inches.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) and is sandy loam or fine sandy loam. The B horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) and is mottled throughout. It typically is sandy loam or fine sandy loam. Reaction ranges from neutral to strongly acid.

The C horizon typically is loamy sand or sand.

Houghton series

The Houghton series consists of very poorly drained soils in depressions on broad drainageways or in seeps on hillsides. A few areas are on stream benches. Permeability ranges from moderately rapid to moderately slow. These soils formed in herbaceous organic material

more than 51 inches thick. Native vegetation was marsh grasses. Slopes range from 0 to 2 percent.

Houghton muck is adjacent to Colo and Elvira soils. Colo and Elvira soils do not have a surface layer of decomposed organic material. They are not so poorly drained as Houghton soils, and are on higher lying positions.

Typical pedon of Houghton muck, 0 to 2 percent slopes, 920 feet east and 2,500 feet south of the northwest corner of sec. 25, T. 79 N., R. 6 W.

Oa1—0 to 3 inches; black (10YR 2/1) sapric material, dark gray (10YR 4/1) dry; about 10 percent fiber, less than 5 percent rubbed; weak fine granular structure; slightly sticky; fibers are herbaceous; slightly acid; gradual boundary.

Oa2—3 to 37 inches; black (N 2/0) sapric material, dark gray (10YR 4/1) dry; about 10 percent fiber, less than 5 percent rubbed; weak coarse blocky structure; slightly sticky; fibers are herbaceous; neutral; gradual boundary.

Oa3—37 to 60 inches; black (10YR 2/1) and very dark grayish brown (10YR 3/2) sapric material, dark gray (10YR 4/1) dry; about 45 percent fiber, less than 5 percent rubbed; weak coarse blocky structure; slightly sticky; fibers are herbaceous; neutral.

The sapric material generally is more than 51 inches in thickness. Some layers have hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 0 through 3. Chroma and value may change from 0.5 to 2 units from the broken face to rubbed colors. The colors of broken faces become darker on brief exposure to air. Reaction for the entire profile ranges from slightly acid to moderately alkaline.

Kenyon series

The Kenyon series consists of moderately well drained, moderately permeable soils that formed in 14 to 24 inches of loamy material and the underlying glacial till. These soils are on ridgetops and side slopes on uplands. Native vegetation was prairie grasses. Slopes range from 2 to 9 percent.

Kenyon soils are commonly adjacent to Bassett, Burkhardt, Dinsdale, and Waubeek soils. Burkhardt soils are underlain by sand and gravel. Dinsdale and Waubeek soils have less sand in the upper part of the solum and are deeper to glacial till than Kenyon soils. Bassett and Burkhardt soils are in positions on the landscape similar to those of the Kenyon soils. Dinsdale and Waubeek soils are on ridges and side slopes above the Kenyon soils.

Typical pedon of Kenyon loam, 2 to 5 percent slopes, 2,100 feet south and 2,570 feet east of the northwest corner of sec. 15, T. 81 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A12—7 to 11 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; clear smooth boundary.

A3—11 to 18 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; strongly acid; clear smooth boundary.

IIB21—18 to 26 inches; dark yellowish brown (10YR 4/4) loam; discontinuous brown (10YR 4/3) coatings on faces of peds; weak fine and medium subangular blocky structure; friable; discontinuous pebble band at a depth of 19 inches; strongly acid; gradual smooth boundary.

IIB22—26 to 32 inches; yellowish brown (10YR 5/6) loam; yellowish brown (10YR 5/4) coatings on faces of peds; moderate medium subangular blocky structure; friable; few discontinuous light gray (10YR 7/2) dry sand coatings on faces of peds; few dark iron concretions; strongly acid; gradual smooth boundary.

IIB23—32 to 45 inches; yellowish brown (10YR 5/6) loam; brown (10YR 4/3) coatings on faces of peds; few fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few discontinuous light gray (10YR 7/2) dry sand coatings on faces of peds; many dark iron concretions; strongly acid; gradual smooth boundary.

IIB3—45 to 53 inches; yellowish brown (10YR 5/6) loam; common fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure; firm; few discontinuous light gray (10YR 7/2) dry sand coatings on faces of peds; many dark iron concretions; medium acid; gradual smooth boundary.

IIC1—53 to 60 inches; mottled yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and light gray (10YR 7/1) loam; massive; firm; many dark iron concretions; medium acid.

The solum ranges from 45 to 66 inches in thickness.

The Ap or A1 horizon is black (10YR 2/1) or very dark brown (10YR 2/2). In areas that are not eroded, the thickness of the A horizon ranges from about 10 to 20 inches. This thickness commonly decreases as slope increases. The A horizon typically is loam but ranges to silt loam that is high in content of sand.

The IIB horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 8. Mottles have chroma of 2 or lower. The IIB horizon typically is loam but ranges to clay loam and sandy clay loam. Reaction in the IIB horizon ranges from medium acid to strongly acid.

The IIC horizon is similar in color and texture to the IIB horizon, except that grayish mottles are more common. The depth to carbonates ranges from 45 to 66 inches.

Klinger series

The Klinger series consists of somewhat poorly drained, moderately permeable soils that formed in 24 to 40 inches of loess and underlying glacial till. These soils are on broad ridges or flats, foot slopes, and side slopes of uplands. Native vegetation was prairie grasses. Slopes range from 1 to 3 percent.

Klinger soils are commonly adjacent to Ansgar, Dinsdale, and Maxfield soils. Franklin soils have a thinner, dark A horizon than Klinger soils. Ansgar soils have a grayer B horizon and are poorly drained. They are in drainageways below the Klinger soils. Dinsdale soils have a browner B horizon and are better drained. They are on convex slopes above the Klinger soils. Maxfield soils are more poorly drained and are in a lower position on the landscape.

Typical pedon of Klinger silty clay loam, 1 to 3 percent slopes, 740 feet west and 60 feet north of the center of sec. 12, T. 80 N., R. 7 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A12—7 to 13 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A3—13 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; very dark gray (10YR 3/1) coatings on faces of peds; moderate fine granular structure parting to weak fine subangular blocky; friable; slightly acid; gradual smooth boundary.

B21t—18 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine and medium subangular blocky structure; friable; thin discontinuous clay films; slightly acid; gradual smooth boundary.

B22t—25 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; thin nearly continuous clay films; slightly acid; abrupt smooth boundary.

IIB3—34 to 48 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) loam; weak medium prismatic structure; firm; slightly acid; abrupt smooth boundary.

IIC—48 to 60 inches; mottled yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) loam; massive; firm; neutral.

The solum ranges from about 40 to 60 inches in thickness.

The A horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2). It grades in value to 3 and has chroma of 1 or 2 in the lower part of the profile. The A horizon ranges from 16 to 22 inches in thickness. It typically is silty clay loam but is silt loam in some pedons.

The B2t horizon is dark grayish brown (10YR 4/2), dark grayish brown (2.5Y 4/2), or grayish brown (2.5Y 5/2). Clay content of the B2t horizon ranges from 28 to 35 percent. Reaction is slightly acid to strongly acid in the A horizon and upper part of the B horizon. The mottled IIBt horizon is grayish brown (2.5Y 5/2), light brownish gray (2.5Y 6/2), or yellowish brown (10YR 5/4 and 5/6). The IIB horizon is loam or clay loam.

Koszta series

The Koszta series consists of somewhat poorly drained, moderately permeable soils that formed in silty alluvium. These soils are on low stream benches or high second bottoms. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Koszta soils are similar to Coppock soils and are commonly adjacent to Bertrand, Tuskeego, and Watkins soils. Coppock soils have a thicker A2 horizon than Koszta soils. Bertrand and Watkins soils are better drained and have a browner B horizon. Tuskeego soils have a grayer B horizon. Bertrand and Watkins soils are on higher lying areas on stream benches. Tuskeego soils are on lower lying areas than the Koszta soils.

Typical pedon of Koszta silt loam, 0 to 2 percent slopes, 2,420 feet south and 27 feet west of the northeast corner of sec. 34, T. 79 N., R. 7 W.

A1—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry, very dark grayish brown (10YR 3/2) kneaded; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) kneaded; weak medium platy structure parting to weak fine granular; friable; few dark iron and manganese concretions; strongly acid; clear smooth boundary.

B1—13 to 21 inches; brown (10YR 4/3) silty clay loam; common fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; thin continuous light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron and manganese concretions; strongly acid; gradual smooth boundary.

B2t—21 to 34 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films; few discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron and manganese concretions; strongly acid; gradual smooth boundary.

B3t—34 to 48 inches; light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) light silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; thin discontinuous clay films; common dark iron and manganese concretions; few small pores; medium acid; gradual smooth boundary.

C—48 to 60 inches; light brownish gray (2.5Y 6/2) light silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive with vertical cleavage; firm; thin discontinuous clay films; common dark iron and manganese concretions; common small pores; neutral.

The solum typically is more than 40 inches thick and ranges from 36 to 60 inches in thickness.

The A1 or Ap horizons are black (10YR 2/1), very dark grayish brown (10YR 2/2), or very dark gray (10YR 3/1). The A2 horizon typically is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). The A horizons are silt loam that range from 18 to 24 percent content of clay.

The upper part of the B horizon is dark grayish brown (10YR 4/2) and is mottled with grayish brown (2.5Y 5/2), gray (5Y 5/1), light gray (5Y 6/1), olive gray (5Y 5/2), and yellowish brown (10YR 5/4, 5/6, and 5/8). The B2 horizon ranges from 28 to 35 percent clay.

The B3t and C horizons are silty clay loam that has clay content ranging from 27 to 30 percent. Reaction ranges from medium acid to strongly acid.

Ladoga series

The Ladoga series consists of moderately well drained soils that formed in loess. Permeability is moderately slow. These soils are on upland ridges and side slopes and on stream benches. Native vegetation was prairie grasses and deciduous trees. Slopes range from 2 to 14 percent.

Ladoga soils are similar to Clinton, Downs, and Otley soils and are commonly adjacent to Armstrong, Clinton, Gara, and Givin soils. Clinton soils have thinner A1 horizons than Ladoga soils. Downs soils are well drained and have less clay in the B horizon. Otley soils have a thicker, dark A horizon and do not have an A2 horizon. Armstrong soils formed in a reddish paleosol. Gara soils formed in glacial till. Givin soils have a browner B horizon. Armstrong and Gara soils are on convex slopes below the Ladoga soils. Clinton soils are in positions on the landscape similar to those of the Ladoga soils. Givin soils are in concave areas above the Ladoga soils.

Typical pedon of Ladoga silt loam, 2 to 5 percent slopes, 1,080 feet south and 640 feet east of the northwest corner of sec. 30, T. 78 N., R. 6 W.

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

A2—7 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium platy structure; friable; neutral; abrupt smooth boundary.

B1—10 to 15 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular structure; friable; few discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; gradual smooth boundary.

B21t—15 to 20 inches; brown (10YR 4/3) silty clay loam; moderate fine angular and subangular blocky structure; firm; few discontinuous clay films; nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B22t—20 to 25 inches; brown (10YR 4/3) silty clay loam; moderate fine and medium angular and subangular structure; firm; few discontinuous clay films and dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B23t—25 to 33 inches; brown (10YR 4/3) silty clay loam; few fine distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate medium angular and subangular blocky; firm; few discontinuous clay films; light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B31t—33 to 43 inches; brown (10YR 5/3) silty clay loam; common fine prominent light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to weak medium angular and subangular blocky; firm; few discontinuous clay films; light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B32t—43 to 49 inches; mottled brown (10YR 5/3) and light brownish gray (2.5Y 6/2) silty clay loam; weak medium prismatic structure; firm; few discontinuous clay films; medium acid; gradual smooth boundary.

C—49 to 60 inches; mottled brown (10YR 5/3) and light brownish gray (2.5Y 6/2) silty clay loam; massive; firm; medium acid.

The thickness of the solum ranges from 36 to 72 inches. The thickness of the mollic epipedon ranges from 6 to 10 inches.

The A1 horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 4 through 6, and chroma of 3 or 4.

The B2t horizon has value of 4 or 5 and chroma of 2 or 3. The gray colors are most common in the lower part of the B horizon. The B horizon ranges from 36 to 42 percent clay. Reaction is medium acid or strongly acid.

The C horizon has value of 5 and chroma of 2 or 3.

Lamont series

The Lamont series consists of well drained soils on upland ridges and side slopes and on high stream benches. These soils formed in sandy and loamy materials that were dominantly wind-deposited. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Native vegetation was deciduous trees. Slopes range from 2 to 30 percent.

Lamont soils are commonly adjacent to Chelsea and Fayette soils. Chelsea soils have more sand in the A horizon than Lamont soils. Fayette soils formed in loess and have silty textures. Both soils are in positions on the landscape similar to those of the Lamont soils.

Typical pedon of Lamont fine sandy loam, 5 to 9 percent slopes, 1,160 feet south and 40 feet west of the northeast corner of sec. 1, T. 80 N., R. 5 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A2—7 to 10 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) fine sandy loam; very weak thin platy structure parting to very weak fine subangular blocky; friable; slightly acid; clear smooth boundary.

B1—10 to 15 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

B2t—15 to 25 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; thin discontinuous clay films; medium acid; gradual smooth boundary.

B3t—25 to 33 inches; yellowish brown (10YR 5/6) fine sandy loam; weak coarse subangular blocky structure; friable; few thin discontinuous clay films; medium acid; gradual smooth boundary.

C—33 to 60 inches; yellowish brown (10YR 5/6) and brownish yellow (10YR 6/8) fine sand; single grain; loose; 1/8-inch thick bands of brown (7.5YR 4/4) loamy sand at depths of 41, 46, 51, and 56 inches; slightly acid.

The solum ranges from 30 to 60 inches in thickness.

The A1 horizon is dark grayish brown (10YR 4/2), dark gray (10YR 4/1), or very dark gray (10YR 3/1). In areas that are not eroded, the A2 horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). The B2 horizon ranges from sandy loam to loam and sandy clay loam. The B horizon has hue of 10YR to 7.5YR, value of 4 to 5, and chroma of 3 to 6. Reaction in the B horizon ranges from medium acid to very strongly acid.

Lawler series

The Lawler series consists of somewhat poorly drained soils on stream benches and on upland outwash plains. These soils formed in about 32 to 40 inches of loamy alluvium underlain by sand and gravel. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Lawler soils are similar to Udolpho soils and are commonly adjacent to Coland, Marshan, and Waukee soils. Udolpho soils have a thinner, dark A1 horizon than Lawler soils and have an A2 horizon. Coland soils have a thicker A horizon and are on bottom lands. Marshan soils are more poorly drained, have grayer B horizons, and are on nearly level positions below the Lawler soils. Waukee soils are better drained, have browner B horizons, and are on higher lying positions above the Lawler soils.

Typical pedon of Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, 1,430 feet east and 2,448 feet south of the northwest corner of sec. 33, T. 81 N., R. 8 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A12—8 to 11 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A3—11 to 14 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular and subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21—14 to 19 inches; dark grayish brown (10YR 4/2) loam; few fine faint strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.

B22—19 to 34 inches; grayish brown (10YR 5/2) loam; many fine faint yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; few dark iron concretions; strongly acid; abrupt smooth boundary.

IIC—34 to 60 inches; grayish brown (10YR 5/2) medium and fine sand; common fine distinct strong brown (7.5YR 5/6) mottles; single grain; loose; many dark iron concretions; strongly acid.

The solum ranges from 32 to 40 inches in thickness. The A horizon ranges from 12 to 24 inches in thickness.

The A horizon is loam or silt loam that is high in content of sand. The B2 horizon typically is mottled dark grayish brown (10YR or 2.5Y 4/2) or olive brown (2.5Y 4/4). It typically is loam but ranges to sandy clay loam.

The C horizon typically is loamy sand or sand. In some areas the C horizon contains gravel.

Lawson series

The Lawson series consists of somewhat poorly drained, moderately permeable soils on first and second bottoms near major streams. These soils formed in silty alluvium. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Lawson soils are similar to Amana soils and are commonly adjacent to Amana, Coppock, Ely, and Perks soils. Amana soils have a thinner, dark A horizon than Lawson soils. They are in positions on the landscape similar to those of the Lawson soils. Coppock soils have an A2 horizon and are in depressions. Ely soils have a thinner, dark surface layer and higher clay content in the control section. They are on foot slopes and alluvial fans. Perks soils are sandy and are closer to the stream channel of flood plains that have recently received sediments.

Typical pedon of Lawson silt loam, 0 to 2 percent slopes, 660 feet east and 45 feet south of the northwest corner of sec. 32, T. 79 N., R. 7 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A12—7 to 16 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky and granular structure; friable; slightly acid; clear wavy boundary.

A13—16 to 24 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; friable; slightly acid; clear wavy boundary.

A14—24 to 31 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; very dark gray (10YR 3/1) and black (10YR 2/1) coatings on faces of peds; moderate medium subangular blocky structure; friable; few dark iron and manganese concretions; slightly acid; clear wavy boundary.

C1—31 to 37 inches; dark grayish brown (10YR 4/2) silt loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine prismatic structure parting to moderate fine and medium angular and subangular blocky; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron and manganese concretions; slightly acid; clear wavy boundary.

C2—37 to 47 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium subangular blocky structure; friable; light gray (10YR 7/2) silt coatings on faces of peds; common dark iron and manganese concretions; medium acid; gradual smooth boundary.

C3—47 to 60 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; dark gray (10YR 4/1) coatings on faces of peds; many coarse distinct brown (10YR 4/3) mottles; weak fine subangular blocky structure; friable; medium acid.

The A horizon is silt loam and ranges to a depth of 30 inches or more. In some pedons thin lenses of silt or very fine sand are between depths of 30 and 40 inches. The mollic epipedon ranges from 24 to 36 inches in thickness. The 10- to 40-inch control section ranges from 18 to 28 percent clay and from slightly acid to neutral.

The C horizon has hue of 10YR or 2.5YR, value of 3 through 6, and chroma of 1 to 3.

Lindley series

The Lindley series consists of moderately well drained soils that formed in loamy glacial till. These soils are on valley side slopes and in narrowly dissected interfluves in uplands. Permeability is moderately slow. Native vegetation was deciduous trees. Slopes range from 9 to 25 percent.

Lindley soils are similar to Armstrong and Gara soils and are commonly adjacent to Armstrong, Clinton, and Fayette soils. Gara and Armstrong soils have a thicker, darker A horizon and a less distinct A2 horizon than Lindley soils. Armstrong soils are on convex slopes above the Lindley soils and are of redder hue. Clinton and Fayette soils formed in loess and are on convex slopes above the Lindley soils.

Typical pedon of Lindley loam, 14 to 18 percent slopes, moderately eroded, 2,600 feet south and 1,920 feet west of the northeast corner of sec. 20, T. 80 N., R. 8 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) and brown (7.5YR 4/4) loam; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

B1—7 to 11 inches; brown (7.5YR 4/4) loam; moderate fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2) coatings on faces of peds; medium acid; gradual smooth boundary.

B21t—11 to 16 inches; yellowish brown (10YR 5/6) loam; moderate fine subangular blocky structure; friable; thin discontinuous light gray (10YR 7/2) coatings on faces of peds; thin discontinuous clay films; medium acid; gradual smooth boundary.

B22t—16 to 22 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure and angular blocky; firm; thin discontinuous light gray (10YR 7/2) coatings on faces of peds; nearly continuous clay films; strongly acid; gradual smooth boundary.

B23t—22 to 31 inches; yellowish brown (10YR 5/6) clay loam; common fine faint light brownish gray (10YR 6/2) and few faint distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to medium subangular and angular blocky; firm; thin discontinuous clay films; few dark iron concretions; strongly acid; gradual smooth boundary.

B3t—31 to 41 inches; yellowish brown (10YR 5/4) clay loam; common fine faint light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure; firm; thin discontinuous clay films; many dark iron concretions; strongly acid; gradual smooth boundary.

C1—41 to 52 inches; mottled yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) loam; massive; firm; many dark iron concretions; medium acid; gradual smooth boundary.

C2—52 to 60 inches; mottled yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) loam; massive; firm; common dark iron concretions; neutral.

The solum ranges from 30 to 50 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 through 4. Where present, the A1 horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). The Ap and A1 horizons are loam or silt loam. The A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 2, 3, or 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 through 6. The B2 horizon is sometimes mottled in the lower part. It is clay loam or loam.

Mahaska series

The Mahaska series consists of somewhat poorly drained, moderately permeable soils on uplands and loess-covered stream benches. These soils formed in loess more than 40 inches thick. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Mahaska soils are commonly adjacent to Givin, Otley, and Taintor soils. Givin soils have a thinner, dark A horizon than Mahaska soils. They are in positions on the landscape similar to those of the Mahaska soils. Otley soils have a browner B horizon and are better drained. They are on convex slopes above the Mahaska soils. Taintor soils are poorly drained and are in shallow depressions.

Typical pedon of Mahaska silty clay loam, 0 to 2 percent slopes, 1,600 feet west and 103 feet south of the northeast corner of sec. 23, T. 78 N., R. 8 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A12—7 to 13 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; medium acid; gradual smooth boundary.

A3—13 to 20 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; moderate fine subangular blocky and granular structure; friable; medium acid; gradual smooth boundary.

B1—20 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; very dark gray (10YR 3/1) coatings on faces of peds; moderate fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21t—26 to 33 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky and angular blocky; friable; few dark iron and manganese concretions; thin discontinuous clay films; medium acid; gradual smooth boundary.

B22t—33 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; many dark iron and manganese concretions; thin discontinuous clay films; medium acid; gradual smooth boundary.

B31t—40 to 47 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; firm; many dark iron and manganese concretions; thin discontinuous clay films; medium acid; gradual smooth boundary.

B32t—47 to 57 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; friable; many dark iron and manganese concretions; thin discontinuous clay films; medium acid; gradual smooth boundary.

C—57 to 60 inches; light olive gray (5Y 6/2) silt loam; common medium prominent strong brown (7.5YR 5/8) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; many dark iron and manganese concretions; friable; neutral.

The solum typically is about 60 inches thick but ranges from 4 to 6 feet in thickness.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), and very dark gray (10YR 3/1). It typically is silty clay loam but is silt loam in some pedons. The A horizon ranges from 14 to 20 inches in thickness. The B2 horizon is silty clay loam or silty clay. Clay content

ranges from about 36 to 42 percent. The B horizon ranges from very strongly acid to medium acid.

The C horizon is silt loam or silty clay loam. Clay content ranges from 24 to 30 percent.

Marshan series

The Marshan series consists of poorly drained soils on low stream benches. These soils formed in 32 to 40 inches of loamy alluvium over sand and gravel. Permeability is moderate to rapid. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Marshan soils are commonly adjacent to Lawler, Udolpho, Watseka, and Waukee soils. Lawler soils are better drained than Marshan soils. Udolpho soils also are better drained and have a thinner, dark A1 horizon. Waukee soils are better drained, have a browner B horizon, and are lower in clay content in the control section. Watseka soils have more sand in the A and B horizons. Lawler, Waukee, and Watseka soils are on higher lying areas on stream benches than the Marshan soils. Udolpho soils are in positions on the landscape similar to those of the Marshan soils.

Typical pedon of Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes; 360 feet east and 100 feet south of the northwest corner of sec. 36, T. 78 N., R. 6 W.

A11—0 to 6 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; clear wavy boundary.

A12—6 to 12 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular and subangular blocky structure; friable; slightly acid; clear wavy boundary.

A3—12 to 17 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; friable; few brown iron concretions; medium acid; clear wavy boundary.

B2g—17 to 25 inches; gray (10YR 5/1) loam; common fine distinct light brownish gray (2.5Y 6/2) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; many dark iron and manganese concretions; medium acid; clear wavy boundary.

B3g—25 to 35 inches; light olive gray (5Y 6/2) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; friable; few dark iron and manganese concretions; medium acid; abrupt wavy boundary.

IIC—35 to 60 inches; grayish brown (10YR 5/2) coarse sand; single grain; loose; few dark iron and manganese concretions; slightly acid.

Thickness of the solum and depth to IIC material ranges from 32 to 40 inches.

The A horizon ranges from black (N 2/0) to very dark gray (10YR 3/1) and from 14 to 24 inches in thickness. It typically is loam but ranges to clay loam. Typically, the B horizon has hue of 5Y, 2.5Y, or 10YR, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam, clay loam, or loam.

The IIC horizon typically is sand or gravelly sand, but in some pedons it is stratified sand, coarse sand, and gravel.

Maxfield series

The Maxfield series consists of poorly drained, moderately permeable soils that formed in 24 to 40 inches of loess and underlying glacial till. These soils are in slight depressions on upland flats and in shallow drainageways. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Maxfield soils are commonly adjacent to Ansgar, Dinsdale, Franklin, Klinger, and Waubeek soils. Ansgar soils have an A2 horizon and an A1 horizon that is thinner than that of the Maxfield soils. They are in positions on the landscape similar to those of the Maxfield soils. Dinsdale, Franklin, Klinger, and Waubeek soils are better drained than the Maxfield soils and have browner B horizons. They generally are in higher lying positions than Maxfield soils.

Typical pedon of Maxfield silty clay loam, 0 to 2 percent slopes, 1,650 feet west and 320 feet north of the center of sec. 12, T. 80 N., R. 7 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A12—8 to 14 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A3—14 to 22 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate fine granular and subangular blocky structure; friable; neutral; clear smooth boundary.

B21g—22 to 28 inches; olive gray (5Y 4/2) silty clay loam; very dark gray (5Y 3/1) on faces of peds; many fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B22g—28 to 38 inches; grayish brown (2.5Y 5/2) silt loam; common fine yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; many dark iron and manganese concretions; neutral; abrupt smooth boundary.

IIB3—38 to 47 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) loam; weak coarse prismatic structure; firm; many dark iron and manganese concretions; mottled yellowish brown (10YR 5/6) and olive gray (5Y 6/2) sand lenses at a depth of 38 to 40 inches; neutral; gradual smooth boundary.

IIC—47 to 60 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) loam; massive; firm; neutral.

The solum typically is about 48 inches thick but ranges from about 40 to 55 inches in thickness.

The A horizon is black (N 2/0 or 10YR 2/1) and very dark gray (10YR or 5Y 3/1). It is silty clay loam that ranges from 30 to 35 percent content of clay. The upper part of the B horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or silt loam that ranges from 25 to 32 percent content of clay. The IIB3 horizon, where present, has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 to 6. It typically is loam but ranges to clay loam and sandy clay loam. A thin layer of loamy sand or sand commonly separates materials I and II.

The IIC horizon has colors similar to those of the IIB3 horizon.

Muscatine series

The Muscatine series consists of somewhat poorly drained, moderately permeable soils that formed in loess more than 40 inches thick. These soils are on broad, upland divides and on foot slopes and side slopes in uplands. Some areas are on loess-covered stream benches. Native vegetation was prairie grasses. Slopes range from 0 to 5 percent.

Muscatine soils are similar to Ely soils and are commonly adjacent to Garwin, Sperry, Tama, and Walford soils. Ely soils have a thicker A horizon than Muscatine soils. Garwin soils are poorly drained and are commonly in a lower position on the landscape. Sperry soils are poorly drained and are in depressions. Tama soils have a browner B horizon and are better drained. They are on convex slopes above the Muscatine soils. Walford soils have an A2 horizon and a grayer B horizon. They are in concave positions below the Muscatine soils.

Typical pedon of Muscatine silt loam, 0 to 2 percent slopes, 133 feet east and 2,500 feet south of the northwest corner of sec. 33, T. 81 N., R. 5 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.

A12—7 to 12 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; strongly acid; clear smooth boundary.

A13—12 to 16 inches; very dark brown (10YR 2/2) silty clay loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; few light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B1—16 to 20 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few light gray (10YR 7/2) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B21t—20 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; friable; few dark iron and manganese concretions; few light gray (10YR 7/2) dry silt coatings on faces of peds; few discontinuous clay films; medium acid; gradual smooth boundary.

B22t—26 to 33 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint yellowish brown (10YR 5/4 and 5/8) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; friable; few dark iron and manganese concretions; few light gray (10YR 7/2) dry silt coatings on faces of peds; few thin discontinuous clay films; medium acid; gradual smooth boundary.

B31t—33 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6 and 5/8) mottles; moderate fine prismatic structure parting to weak medium subangular blocky; friable; few dark iron and manganese concretions; few light gray (10YR 7/2) dry silt coatings on faces of peds; few thin discontinuous clay films; slightly acid; gradual smooth boundary.

B32—40 to 45 inches; grayish brown (2.5Y 5/2) silt loam; many medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) mottles; weak medium prismatic structure; friable; few clay flows in old root channels; few dark iron and manganese concretions; slightly acid; gradual smooth boundary.

C—45 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; friable; many dark iron and manganese concretions; neutral.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2). It ranges from 14 to 20 inches in thickness. The A horizon is silty clay loam or silt loam. The B horizon has hue of 10YR or 2.5Y, value of 4 to 5, and chroma of 2. Mottles are higher in chroma. The B2 horizon ranges from 27 to 35 percent content of clay. Reaction ranges from strongly acid to medium acid.

Nevin series

The Nevin series consists of somewhat poorly drained, moderately permeable soils that formed in silty alluvium. These soils are on stream benches along major

drainageways. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Nevin soils are commonly adjacent to Amana, Bremer, Raddle, Tuskeego, and Wiota soils. Amana soils are lower in clay content than the Nevin soils. Bremer soils have a higher clay content in the control section and are more poorly drained. Raddle and Wiota soils have a lower clay content in the control section and are better drained. Tuskeego soils have a grayer B horizon than Nevin soils and are poorly drained. Amana soils are on bottom lands. Bremer and Tuskeego soils are on low lying areas below the Nevin soils. Raddle and Wiota soils are on higher lying areas.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, 2,140 feet south and 18 feet west of the northeast corner of sec. 6, T. 78 N., R. 6 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; weak fine granular and subangular structure; friable; neutral; abrupt smooth boundary.

A12—9 to 14 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A3—14 to 22 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; weak fine granular and subangular blocky structure; friable; neutral; gradual smooth boundary.

B21—22 to 27 inches; dark grayish brown (2.5Y 4/2) silty clay loam; very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

B22t—27 to 33 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent strong brown (7.5YR 5/6) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; firm; thin discontinuous clay films; few dark iron and manganese concretions; slightly acid; gradual smooth boundary.

B3t—33 to 46 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent strong brown (7.5YR 5/6) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; thin discontinuous clay films; common dark iron and manganese concretions; neutral; gradual smooth boundary.

C—46 to 60 inches; grayish brown (2.5Y 5/2) silt loam; common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; few dark iron and manganese concretions; neutral.

The solum typically is more than 40 inches thick and ranges from 36 to 60 inches or more in thickness.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), and very dark grayish brown (10YR 3/2). It ranges from about 16 to 24 inches in thickness but in a few places is as much as 30 inches thick. The A horizon typically is silty clay loam but ranges to silt loam.

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. It has mottles of high chroma. Reaction is medium acid to slightly acid.

Nodaway series

The Nodaway series consists of moderately well drained, moderately permeable soils that formed in recently deposited silty alluvium. These soils are stratified because each flood deposits fresh sediment on the surface layer. They are on flood plains, alluvial fans, and narrow upland waterways that are associated with steep, loess soils. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Nodaway soils are similar to Arenzville soils and are commonly adjacent to Arenzville, Bertrand, Lawson, and Spillville soils. Arenzville soils have dark buried soil overlain by recent alluvium 20 to 40 inches thick. Bertrand soils do not have the stratification of Nodaway soils and are on stream terraces. Lawson and Spillville soils have thicker, darker A horizons. Arenzville, Lawson, and Spillville soils are in positions on the landscape similar to those of the Nodaway soils.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, 1,560 feet west and 2,580 feet south of the northeast corner of sec. 20, T. 80 N., R. 6 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry, very dark grayish brown (10YR 3/2), kneaded; weak, thin platy structure parting to weak fine granular; friable; thin strata of very pale brown (10YR 7/3) silt loam; slightly acid; clear smooth boundary.

C—6 to 60 inches; stratified very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam; weak thin platy structure due to stratification; friable; brown (7.5YR 4/4) iron stains, especially in root channels; dark reddish brown (5YR 3/3) iron band at a depth of 47 inches; very thin strata of sandy loam at a depth of 37 inches; neutral.

Reaction is slightly acid to neutral throughout the profile.

The A1 horizon ranges from 6 to 10 inches thick. It is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and commonly is stratified. In cultivated areas the Ap horizon is very dark grayish brown (10YR 3/2).

The underlying C horizon dominantly has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. Some strata have chroma of 1. Strata of material coarser than silt loam are at a depth of less than 40 inches.

Otley series

The Otley series consists of moderately well drained, moderately permeable soils that formed in loess. These soils are in convex positions on ridgetops and upper side slopes in uplands and on high stream benches. Native vegetation was prairie grasses. Slopes range from 2 to 14 percent.

Otley soils are similar to Tama soils and are commonly adjacent to Mahaska and Taintor soils. Tama soils have less clay in the B horizon than Otley soils. Mahaska soils have thicker A horizons, lower chroma and more mottles in the upper part of the B horizon, and are more poorly drained. Taintor soils have a thicker A horizon, lower chroma in the B horizon, and are also more poorly drained. Mahaska and Taintor soils are on concave slopes below the Otley soils.

Typical pedon of Otley silty clay loam, 2 to 5 percent slopes, 2,490 feet north and 80 feet west of the southeast corner of sec. 30, T. 78 N., R. 7 W.

Ap—0 to 8 inches; black (10YR 2/1) light silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A12—8 to 13 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; friable; medium acid; gradual smooth boundary.

A3—13 to 19 inches; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; some brown (10YR 4/3) mixing; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21t—19 to 24 inches; brown (10YR 4/3) silty clay loam; weak fine and medium subangular blocky structure; firm; some very dark gray (10YR 3/1) clay coatings on faces of peds; few dark iron concretions; strongly acid; gradual smooth boundary.

B22t—24 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; few fine distinct grayish brown (2.5Y 5/2) mottles; moderate medium angular and subangular blocky structure; firm; thin discontinuous clay films; few dark iron concretions; discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B23t—30 to 38 inches; yellowish brown (10YR 5/4) silty clay loam; many fine faint strong brown (7.5YR 5/6) and few fine distinct grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to moderate medium angular and subangular blocky; firm; thin discontinuous clay films; few dark iron concretions; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; diffuse wavy boundary.

B3t—38 to 47 inches; mottled yellowish brown (10YR 5/4), grayish brown (2.5Y 5/2), and strong brown (7.5YR 5/6) silty clay loam; weak coarse prismatic structure; friable; few thin discontinuous clay films; few thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; diffuse wavy boundary.

C—47 to 65 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; friable; many dark iron concretions; medium acid.

The solum typically is about 60 inches thick but ranges from 45 to 72 inches in thickness.

The A horizon ranges from 10 to 20 inches in thickness. It is black (10YR 2/1) or very dark brown (10YR 2/2). Where the soil is eroded, the Ap horizon typically is very dark grayish brown (10YR 3/2). The A horizon is silty clay loam that ranges from 28 to 34 percent clay.

The B2 horizon ranges from about 36 to 42 percent clay. The upper and middle parts commonly are brown (10YR 4/3) or dark yellowish brown (10YR 4/4), but some pedons are brown (10YR 5/3) or yellowish brown (10YR 5/4). Mottles are few and faint in the uppper part of the B horizon and increase in abundance and contrast as depth increases. Reaction ranges from medium acid to strongly acid in the B horizon and the lower part of the A horizon.

The C horizon has hue of 10YR through 5Y, value of 5 or 6, and chroma ranging from 2 through 8. It ranges from silty clay loam to silt loam.

The Otley soils in map units 281C2 and 281D2 are taxadjuncts to the Otley series because the dark surface layer is thinner than is required for a mollic epipedon.

Perks series

The Perks series consists of excessively drained, rapidly permeable soils that formed in stratified, dominantly sandy alluvium. These soils are on broad flood plains. Native vegetation was deciduous trees. Slopes range from 0 to 2 percent.

Perks soils commonly are adjacent to Amana, Lawson, and Spillville soils. Amana soils are somewhat poorly drained and have A and B horizons of silt loam. Lawson soils are somewhat poorly drained and have a thick, dark A horizon. Spillville soils have a thick, dark A horizon and are moderately well drained and somewhat poorly drained. All of these soils are on lower lying areas than the Perks soils.

Typical pedon of Perks sandy loam, 0 to 2 percent slopes, 2,000 feet west and 1,900 feet south of the northeast corner of sec. 14, T. 78 N., R. 6 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.
C1—8 to 16 inches; brown (10YR 4/3) fine sand; single grain; loose; medium acid; gradual smooth boundary.
C2—16 to 22 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) medium and fine sand; single grain; loose; slightly acid; gradual smooth boundary.
C3—22 to 32 inches; yellowish brown (10YR 5/4) medium sand; single grain; loose; slightly acid; abrupt smooth boundary.
C4—32 to 45 inches; yellowish brown (10YR 5/4) medium sand; single grain; loose; stratified bands of brown (10YR 4/3) loamy sand between depths of 32 to 35 inches and 42 to 43 inches; medium acid; abrupt smooth boundary.
C5—45 to 55 inches; yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) medium sand; single grain; loose; slightly acid; abrupt smooth boundary.
C6—55 to 60 inches; very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) loamy sand; few fine distinct brown (7.5YR 4/4) mottles; single grain; loose; slightly acid.

The Ap horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), dark grayish brown (10YR 4/2), or brown (10YR 4/3). The C horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 6. It is dominantly medium sand but ranges to loamy sand. Thin strata of finer textures are within the range of the series.

Raddle series

The Raddle series consists of well drained, moderately permeable soils that formed in silty alluvium. These soils are on benches along major streams. Native vegetation was prairie grasses. Slopes range from 1 to 3 percent.

Raddle soils are commonly adjacent to Nevin, Rowley, and Waukegan soils. Nevin and Rowley soils have grayer B horizons than Raddle soils. They are more poorly drained and have more clay in the B horizon. Waukegan soils have contrasting textures of sand or loamy sand at a depth of less than 40 inches. Nevin and Rowley soils are on stream benches below the Raddle soils. Waukegan soils are in positions on the landscape similar to those of the Raddle soils.

Typical pedon of Raddle silt loam, 1 to 3 percent slopes, 1,040 feet south and 1,320 feet east of the northwest corner of sec. 4, T. 80 N., R. 8 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A12—8 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine subangular blocky structure parting to moderate fine granular; friable; neutral; gradual smooth boundary.
A3—14 to 23 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.
B1—23 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.
B21—28 to 36 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.
B22—36 to 44 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; few discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; clear smooth boundary.
B23—44 to 58 inches; yellowish brown (10YR 5/4) silt loam; weak medium prismatic structure parting to moderate fine subangular blocky; friable; thick continuous light gray (10YR 7/2) silt coatings on faces of peds; few dark iron concretions; neutral; clear smooth boundary.
IIB3—58 to 60 inches; dark brown (10YR 3/3) loam; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few dark iron concretions; slightly acid.

The solum ranges from 40 inches to more than 65 inches in thickness.

The A horizon ranges from black (10YR 2/1) or very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). It ranges from 10 to 23 inches in thickness. The B horizon has hue of 10YR, value of 3 or 4, and chroma of 3 to 6. The B2 horizon is silt loam that ranges from 18 to 26 percent content of clay.

The IIB3 horizon is silt loam or loam and typically has more content of sand.

Rowley series

The Rowley series consists of somewhat poorly drained, moderately permeable soils that formed in silty alluvium. These soils are on stream benches along major

drainageways. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

The Rowley soil in Johnson County is a taxadjunct to the Rowley series because it does not have an argillic horizon and typically is loam or silt loam to a depth of 60 inches.

Rowley soils are commonly adjacent to Bremer, Colo, and Raddle soils. Bremer soils have higher clay content in the control section than the Rowley soils and are poorly drained. Colo soils have a thicker, dark A horizon and are poorly drained. Raddle soils have a browner B horizon and are better drained. Bremer and Colo soils are on low lying areas below the Rowley soils. Raddle soils are on higher lying areas.

Typical pedon of Rowley silt loam, 0 to 2 percent slopes, 1,420 feet east and 2,600 feet north of the southwest corner of sec. 33, T. 79 N., R. 8 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A12—7 to 14 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular and subangular blocky structure; friable; slightly acid; clear wavy boundary.

A3—14 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular and subangular blocky structure; friable; medium acid; clear wavy boundary.

B1t—17 to 22 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; thin discontinuous clay films; medium acid; clear wavy boundary.

B21t—22 to 28 inches; brown (10YR 5/3) silt loam; grayish brown (10YR 5/2) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; thin discontinuous clay films; medium acid; clear wavy boundary.

B22t—28 to 35 inches; brown (10YR 5/3) silt loam; common medium faint yellowish brown (10YR 5/6 and 5/8) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin discontinuous clay films; few dark iron and manganese concretions; medium acid; clear wavy boundary.

B3t—35 to 46 inches; light brownish gray (10YR 6/2) silt loam; many medium faint yellowish brown (10YR 5/6 and 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few clay flows in root channels; few dark iron and manganese concretions; medium acid; clear wavy boundary.

C1—46 to 55 inches; light brownish gray (2.5Y 6/2) silt loam; many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; numerous dark iron and manganese concretions; medium acid; gradual boundary.

C2—55 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; neutral.

The solum typically is 40 to 50 inches thick but ranges from 36 to 60 inches or more in thickness.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). It ranges from 10 to 20 inches in thickness. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It has mottles of high chroma. The Bt horizon typically is silt loam, but some pedons are loam. It ranges from 24 to 28 percent clay. The B horizon ranges from slightly acid to medium acid.

Sattre series

The Sattre series consists of well drained soils on stream benches or on uplands. These soils formed in loamy material underlain by loamy sand, sand, or gravel. Permeability is moderate over rapid. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 5 percent.

Sattre soils are similar to Waukee soils and are commonly adjacent to Udolpho and Whittier soils. Waukee soils have a thicker, dark surface layer than Sattre soils. Udolpho soils are more poorly drained. Whittier soils have more silt and less sand in the upper part of the solum. Udolpho soils are on low lying areas below the Sattre soils. Whittier soils are in positions on the landscape similar to those of the Sattre soils.

Typical pedon of Sattre loam, 0 to 2 percent slopes, 2,000 feet south and 1,520 feet east of the northwest corner of sec. 9, T. 81 N., R. 6 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A2—7 to 12 inches; brown (10YR 4/3) loam; moderate medium platy structure; friable; medium acid; clear wavy boundary.

B21t—12 to 19 inches; dark yellowish brown (10YR 4/4) loam; dark yellowish brown (10YR 3/4) coatings on faces of peds; weak fine subangular blocky structure; friable; thin discontinuous clay films; strongly acid; clear smooth boundary.

B22t—19 to 26 inches; dark yellowish brown (10YR 4/4) sandy clay loam; brown (7.5YR 4/4) coatings on faces of peds; weak medium prismatic structure parting to weak medium subangular blocky; friable; thin discontinuous clay films; strongly acid; abrupt smooth boundary.
IIB31—26 to 31 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; loose; strongly acid; clear smooth boundary.
IIB32—31 to 41 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; strongly acid; gradual smooth boundary.
IIC—41 to 60 inches; yellowish brown (10YR 5/6) sand; single grain; loose; strongly acid.

The A1 or Ap horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2) and ranges from 6 to 9 inches thick. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A horizon is loam or silt loam and is high in content of sand.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. The B horizon is loam or sandy clay loam that grades to sandy loam or loamy sand in the lower part. Clay content of the B horizon ranges from 15 to 20 percent. The C horizon is loamy sand or sand that has gravel in places.

Sparta series

The Sparta series consists of excessively drained, rapidly permeable soils that formed in sand deposited dominantly by wind. These soils are on stream benches and uplands. Native vegetation was prairie grasses. Slopes range from 0 to 18 percent.

Sparta soils are similar to Chelsea soils and are commonly adjacent to Bolan, Dickinson, Flagler, Hoopeston, and Watseka soils. Chelsea soils have thinner, dark A horizons than Sparta soils. Bolan, Dickinson, Flagler, and Hoopeston soils have less sand in the A and B horizons. Watseka soils have grayer B horizons. These soils are in positions on the landscape similar to the Sparta soils.

Typical pedon of Sparta loamy fine sand, 2 to 5 percent slopes, 2,585 feet east and 43 feet south of the northwest corner of sec. 17, T. 80 N., R. 7 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; slightly acid; abrupt smooth boundary.
A12—7 to 16 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; very friable; medium acid; clear wavy boundary.
A3—16 to 27 inches; dark brown (10YR 3/3) loamy fine sand, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; very friable; medium acid; clear wavy boundary.
B2—27 to 35 inches; dark yellowish brown (10YR 4/4) loamy fine sand; single grain; loose; medium acid; gradual wavy boundary.
C—35 to 60 inches; yellowish brown (10YR 5/6) medium and fine sand; single grain; loose; medium acid.

Reaction is strongly acid to medium acid throughout except for the Ap horizon, which varies widely as a result of local liming practices.

The solum ranges from 24 inches to about 40 inches in thickness.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It ranges from 15 to 30 inches in thickness. The A horizon ranges from loamy fine sand to loamy sand or fine sand. The B horizon has hue of 10YR or 7.5YR and ranges from 3 to 6 in value and chroma. The B horizon is sand, fine sand, loamy sand, or loamy fine sand.

Sperry series

The Sperry series consists of very poorly drained or poorly drained, slowly permeable soils that formed in loess more than 40 inches thick. These soils are on uplands. Native vegetation was prairie grasses. Slopes range from 0 to 1 percent.

The Sperry soils are commonly adjacent to Atterberry, Garwin, and Muscatine soils. Atterberry soils are better drained than Sperry soils. Garwin soils have a thicker, dark A horizon. Muscatine soils are better drained and also have a thicker, dark A horizon. Tama soils have a browner B horizon and are better drained. These soils are on higher lying positions above the Sperry soils.

Typical pedon of Sperry silt loam, 0 to 1 percent slopes, 28 feet west and 450 feet south of the northeast corner of sec. 19, T. 78 N., R. 5 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.
A12—7 to 10 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak thin platy structure parting to weak fine subangular blocky; friable; slightly acid; abrupt smooth boundary.
A21—10 to 13 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure parting to weak fine subangular blocky; friable; few dark iron and manganese concretions; slightly acid; abrupt smooth boundary.
A22—13 to 17 inches; gray (10YR 5/1) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak fine subangular blocky; few dark iron and manganese concretions; slightly acid; abrupt smooth boundary.

A3—17 to 20 inches; light brownish gray (10YR 6/2) silt loam; black (10YR 2/1) coatings on faces of peds; gray (10YR 5/1) crushed; weak fine subangular blocky structure; few dark iron and manganese concretions; medium acid; clear smooth boundary.

B21tg—20 to 29 inches; very dark gray (10YR 3/1) silty clay; moderate medium prismatic structure parting to moderate medium angular blocky; firm; thin discontinuous interfingering of light brownish gray (10YR 6/2) on faces of peds; thin discontinuous clay films; medium acid; gradual smooth boundary.

B22tg—29 to 36 inches; very dark gray (10YR 3/1) silty clay; black (10YR 2/1) coatings on faces of peds; few fine faint yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to moderate fine angular blocky; firm; few light gray (10YR 7/2) dry silt coatings on faces of peds; thin discontinuous clay films; medium acid; gradual smooth boundary.

B23tg—36 to 41 inches; dark gray (5Y 4/1) silty clay; very dark gray (10YR 3/1) coatings on faces of peds; common fine prominent strong brown (7.5YR 5/6) and gray (N 5/0) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; thin discontinuous clay films; medium acid; gradual smooth boundary.

B31tg—41 to 51 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; firm; thin discontinuous clay films; slightly acid; gradual smooth boundary.

B33tg—51 to 60 inches; olive gray (5Y 5/2) and light olive gray (5Y 6/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; firm; thin discontinuous clay films in root channels; slightly acid.

The solum ranges from 48 to 68 inches in thickness.

The A1 or Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1) and is 8 to 10 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 3 through 6, and chroma of 1 or 2. It ranges from 6 to 12 inches in thickness. Silt coats are prominent if the peds are dry. The B2t horizon ranges from hue of 10YR through 5Y. It has value of 3 to 5 and chroma of 1 or 2. Clay content of the Bt horizon ranges from 36 to 42 percent but may range to as much as 48 percent clay in thin subhorizons that are less than 6 inches thick. Reaction in the upper part of the B horizon is medium acid to strongly acid.

Spillville series

The Spillville series consists of moderately well drained and somewhat poorly drained, moderately permeable soils that formed in loamy alluvium. These soils are on flood plains and along intermittent streams and drainageways. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Spillville soils are commonly adjacent to Colo, Nodaway, and Perks soils. Colo soils are higher in clay content and are more poorly drained than Spillville soils. Nodaway soils are lighter colored, have less content of sand and are more stratified. Perks soils have higher content of sand. These soils are in positions on the landscape similar to those of the Spillville soils.

Typical pedon of Spillville loam, 0 to 2 percent slopes, 1,240 feet south and 80 feet west of the northeast corner of sec. 24, T. 80 N., R. 7 W.

A11—0 to 20 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A12—20 to 37 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky and granular structure; friable; slightly acid; gradual smooth boundary.

A13—37 to 47 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; few fine faint brown (10YR 4/3) mottles; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C—47 to 60 inches; very dark grayish brown (10YR 3/2) loam; few fine faint brown (10YR 4/3) mottles; weak coarse subangular blocky structure; friable; slightly acid.

The solum ranges from 30 to 56 inches in thickness. Reaction is commonly neutral to medium acid.

The A horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2) but in some places is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1) in the lower part. These colors extend to a depth of 40 inches or more. The A horizon typically is loam but is silt loam in some pedons. Clay content is 18 to 26 percent.

The C horizon commonly has hue of 10YR but in places has hue of 2.5Y. It has value of 3 or 4 and chroma of 1 to 2.

Stronghurst series

The Stronghurst series consists of somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess more than 40 inches thick. Native vegetation was deciduous trees. Slopes range from 0 to 2 percent.

Stronghurst soils are similar to Atterberry soils and are commonly adjacent to Downs and Fayette soils. Atterberry soils have a thicker, darker A horizon than Stronghurst soils. Downs and Fayette soils have a browner B horizon and are better drained. Downs and Fayette soils are on convex slopes above the Stronghurst soils.

Typical pedon of Stronghurst silt loam, 0 to 2 percent slopes, 10 feet west and 1,330 feet south of the northeast corner of sec. 13, T. 80 N., R. 6 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam; weak fine granular structure; medium acid; abrupt smooth boundary.

A2—7 to 12 inches; pale brown (10YR 6/3) silt loam, gray (10YR 6/1) dry; light brownish gray (10YR 6/2) coatings on faces of peds; weak thin platy structure parting to weak fine granular; friable; few dark manganese concretions; medium acid; clear smooth boundary.

B1—12 to 16 inches; grayish brown (10YR 5/2) silty clay loam; weak medium subangular blocky structure; friable; few dark manganese concretions; medium acid; gradual smooth boundary.

B21t—16 to 22 inches; brown (10YR 5/3) silty clay loam; grayish brown (10YR 5/2) coatings on faces of peds; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few dark manganese concretions; thin discontinuous clay films; medium acid; gradual smooth boundary.

B22t—22 to 30 inches; brown (10YR 5/3) silty clay loam; grayish brown (10YR 5/2) coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; firm; few dark manganese concretions; thin discontinuous clay films; medium acid; gradual smooth boundary.

B3—30 to 46 inches; light brownish gray (2.5Y 6/2) silty clay loam; moderate medium faint yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; friable; few dark manganese concretions; medium acid; gradual smooth boundary.

C—46 to 60 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) silt loam; massive; friable; few dark manganese concretions; medium acid.

The solum ranges from 3 1/2 to 5 feet in thickness.

The Ap horizon ranges from 5 to 7 inches in thickness. The A2 horizon is 3 to 5 inches thick and is lighter in color than the Ap horizon. The A horizons are silt loam that range from 20 to 27 percent in content of clay.

The B2t horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3. Clay content ranges from about 27 to 35 percent. Reaction is medium acid or strongly acid. Mottles in the B horizon generally have hue of 10YR, 7.5YR, or 2.5Y, and value and chroma of 5 or 6.

The C horizon ranges from medium acid to neutral and has color ranges similar to those of the B horizon. It is silt loam that has clay content ranging from 20 to 27 percent.

Taintor series

The Taintor series consists of poorly drained soils on uplands. These soils formed in loess more than 40 inches thick. Permeability is moderately slow. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Taintor soils are commonly adjacent to Mahaska and Otley soils. Mahaska soils are better drained than Taintor soils. Otley soils have a browner B horizon and also are better drained. These soils are on slopes above the Taintor soils.

Typical pedon of Taintor silty clay loam, 0 to 2 percent slopes, 2,340 feet west and 100 feet south of the northeast corner of sec. 23, T. 78 N., R. 8 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A12—7 to 13 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A3—13 to 17 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; few fine distinct dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B1—17 to 21 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; black (10YR 2/1) coatings on faces of peds; few fine faint dark yellowish brown (10YR 4/4) and few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine and medium subangular blocky structure; firm; few tubular pores; medium acid; clear smooth boundary.

B21tg—21 to 27 inches; grayish brown (2.5Y 5/2) silty clay; dark gray (10YR 4/1) coatings on faces of peds; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; many dark iron and manganese concretions; thick continuous clay films; medium acid; gradual smooth boundary.

B22tg—27 to 38 inches; olive gray (5Y 5/2) silty clay; dark gray (10YR 4/1) coatings on faces of peds; few fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; many dark iron and manganese concretions; thick continuous clay films; medium acid; clear wavy boundary.

B31tg—38 to 47 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6 and 5/8) mottles; moderate coarse prismatic structure; friable; many dark iron and manganese concretions; thin discontinuous clay films; slightly acid; gradual smooth boundary.

B32tg—47 to 65 inches; olive gray (5Y 5/2) and light olive gray (5Y 6/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; friable; many dark iron and manganese concretions; very dark gray (10YR 3/1) clay flows in root channels; neutral; gradual wavy boundary.

C—65 to 70 inches; olive gray (5Y 5/2) and light olive gray (5Y 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; massive; friable; many dark iron and manganese concretions; neutral.

The solum ranges from 42 to 72 inches in thickness.

The Ap horizon is black (10YR 2/1) to very dark gray (10YR 3/1). The A horizon ranges from 16 to 24 inches in thickness. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 to 6, and chroma of 1 to 4. The B2 horizon is silty clay loam or silty clay that ranges from about 38 to 42 percent clay. Reaction ranges from medium acid to slightly acid.

The C horizon is silty clay loam or silt loam that ranges from about 24 to 30 percent clay.

Tama series

The Tama series consists of well drained, moderately permeable soils that formed in loess more than 40 inches thick. These soils are on uplands, and a few areas are on loess covered stream benches. Native vegetation was prairie grasses. Slopes range from 2 to 14 percent.

Tama soils are similar to Otley soils and are commonly adjacent to Atterberry, Downs, Garwin, and Muscatine soils. Otley soils have more clay in the B horizon than Tama soils. Atterberry, Garwin, and Muscatine soils have a grayer B horizon and are more poorly drained. Downs soils have a thinner, dark A1 horizon, and they have an A2 horizon. Atterberry and Muscatine soils are on slightly concave areas below the Tama soils. Downs soils are in positions on the landscape similar to those of the Tama soils. Garwin soils are on broad flats below the Tama soils.

Typical pedon of Tama silt loam, 2 to 5 percent slopes, 81 feet south and 1,920 feet east of the northwest corner of sec. 15, T. 77 N., R. 5 W.

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

A12—7 to 11 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; slightly acid; gradual smooth boundary.

A3—11 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; medium acid; gradual smooth boundary.

B1—17 to 23 inches; brown (10YR 4/3) silty clay loam; very dark gray (10YR 3/1) coatings on faces of peds; weak fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.

B2t—23 to 31 inches; dark yellowish brown (10YR 4/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; few light gray (10YR 7/2) dry coatings on faces of peds; few thin discontinuous clay films; strongly acid; gradual smooth boundary.

B3—31 to 43 inches; yellowish brown (10YR 5/4) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; few fine faint light brownish gray (10YR 6/2) mottles in lower part of horizon; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few thin discontinuous clay films in root channels; few light gray (10YR 7/2) coatings on faces of peds; strongly acid; gradual smooth boundary.

C—43 to 60 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light gray (10YR 7/2) and strong brown (7.5YR 5/6) mottles; massive; friable; few light gray (10YR 7/2) dry coatings on faces of peds; neutral.

The solum ranges from about 36 to 60 inches in thickness.

The A1 or Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The A horizon ranges from 13 to 20 inches in thickness in uneroded areas. It is silt loam or silty clay loam. The B horizon typically has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. The B2t horizon ranges from 28 to 34 percent content of clay. Depth to grayish mottles ranges from about 30 to 50 inches. Reaction is medium acid to strongly acid.

The Tama soils in map units 120C2 and 120D2 are taxadjuncts to the Tama series because the dark surface layer is thinner than is required for a mollic epipedon.

Tuskeego series

The Tuskeego series consists of poorly drained, very slowly permeable soils that formed in silty alluvium. These soils are on nearly level to slightly depressed stream benches. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

The Tuskeego soils are commonly adjacent to Koszta, Nevin, and Watkins soils. Koszta, Nevin, and Watkins

soils are better drained than Tuskeego soils, and, in addition, Nevin soils have a thicker, dark A horizon, and Watkins soils have a browner B horizon. These soils are on higher lying areas on stream benches above the Tuskeego soils.

Typical pedon of Tuskeego silt loam, 0 to 2 percent slopes, 195 feet east and 30 feet south of the northwest corner of sec. 9, T. 78 N., R. 6 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A21—9 to 14 inches; dark grayish brown (10YR 4/2) silt loam; very dark gray (10YR 3/1) coatings on faces of peds; few fine faint yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

A22—14 to 19 inches; dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) silt loam; few fine faint yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to weak fine granular and subangular blocky; friable; medium acid; clear smooth boundary.

B1t—19 to 22 inches; dark gray (10YR 4/1) silty clay loam; common fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; thin discontinuous clay films; thin continuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

B21tg—22 to 28 inches; dark gray (10YR 4/1) silty clay loam; common fine faint yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; thick continuous clay films; medium acid; gradual smooth boundary.

B22tg—28 to 35 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine faint yellowish brown (10YR 5/6 and 5/8) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; thin continuous clay films; few black (10YR 2/1) clay flows in root channels; few dark iron and manganese concretions; medium acid; gradual smooth boundary.

B23tg—35 to 45 inches; olive gray (5Y 5/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films; few clay flows in root channels; few dark iron and manganese concretions; slightly acid; gradual smooth boundary.

B3tg—45 to 52 inches; light olive gray (5Y 6/2) silty clay loam; few medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; firm; few clay flows in root channels; few dark iron and manganese concretions; neutral; gradual smooth boundary.

C—52 to 60 inches; light olive gray (5Y 6/2) silt loam; few medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; few clay flows in root channels; few dark iron and manganese concretions; neutral.

The solum ranges from 48 to 72 inches in thickness.

The A1 or Ap horizon typically is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 6 to 9 inches thick. The A2 horizon typically is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2) but ranges in value from 4 to 6 and in chroma of 1 or 2. It ranges from 6 to 12 inches in thickness. The B1 horizon ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). It has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. The B2 horizon is silty clay loam or silty clay that ranges from 38 to 48 percent in content of clay.

The C horizon is silt loam or silty clay loam.

Udolpho series

The Udolpho series consists of somewhat poorly drained or poorly drained soils on uplands and stream benches. These soils formed in loamy material over loamy sand and sand. Permeability is moderate over rapid. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Udolpho soils are similar to Lawler soils and are commonly adjacent to Coland, Marshan, and Sattre soils. Lawler, Coland, and Marshan soils have a thicker A horizon than Udolpho soils and do not have an A2 horizon. Sattre soils are better drained and have a browner B horizon. Coland soils are on bottom lands. Marshan soils are on low lying areas on stream benches. Sattre soils are on higher lying areas.

Typical pedon of Udolpho loam, 0 to 2 percent slopes, 330 feet east and 2,529 feet south of the northwest corner of sec. 26, T. 79 N., R. 6 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak fine granular structure; friable; few fine faint brown (7.5YR 4/4) iron stains in root channels; strongly acid; abrupt smooth boundary.

A2—7 to 14 inches; dark grayish brown (10YR 4/2) loam; very dark gray (10YR 3/1) coatings on faces of peds; weak medium platy structure parting to weak fine granular; friable; common fine distinct brown (7.5YR 4/4) iron stains in root channels; medium acid; clear smooth boundary.

B1tg—14 to 18 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) loam; common medium distinct brown (7.5YR 4/4) mottles; weak fine granular and subangular blocky structure; friable; thin discontinuous clay films; strongly acid; clear wavy boundary.

B21tg—18 to 22 inches; grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films; strongly acid; clear wavy boundary.

B22tg—22 to 28 inches; grayish brown (10YR 5/2) loam; many medium distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; thin discontinuous clay films; strongly acid; clear wavy boundary.

B3g—28 to 33 inches; grayish brown (10YR 5/2) sandy loam; common medium distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; strongly acid; clear wavy boundary.

IIC1—33 to 40 inches; light brownish gray (2.5Y 6/2) loamy sand; few fine distinct brown (7.5YR 4/4) mottles; single grain; loose; very strongly acid; abrupt smooth boundary.

IIC2—40 to 46 inches; brown (7.5YR 4/4) loamy sand; single grain; loose; few pea size gravel; strongly acid; clear wavy boundary.

IIC3—46 to 60 inches; pale brown (10YR 6/3) fine sand; single grain; loose; few dark iron concretions at a depth of 54 inches; strongly acid.

The thickness of the solum and the depth to sand or sandy-skeletal material ranges from 20 to 40 inches. The sola typically do not have coarse fragments, but a few pedons are as much as 10 percent gravel.

The IIC horizons range from 10 to 50 percent gravel.

The Ap horizon is black (10YR 2/1) or very dark gray (10YR 2/2). The A2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It ranges from 4 to 10 inches in thickness. The B horizon typically has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 1 or 2. The upper part of the B horizon typically is silt loam or loam. The lower part is loam, sandy loam, or sandy clay loam.

The IIC horizon has hue of 2.5Y or 5Y. It is coarse sand, sand, or loamy sand.

Walford series

The Walford series consists of poorly drained, slowly permeable soils that formed in loess more than 40 inches thick. These soils are on uplands or on stream benches. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 1 percent.

Walford soils are similar to Atterberry soils and are commonly adjacent to Atterberry, Muscatine, and Tama soils. Atterberry soils are better drained than Walford soils and do not have a prominent A2 horizon. Muscatine soils are better drained and do not have an A2 horizon. Tama soils are better drained and have a browner B horizon. The Atterberry, Muscatine, and Tama soils are on slopes above the Walford soils.

Typical pedon of Walford silt loam, 0 to 1 percent slopes, 200 feet east and 2,110 feet north of the southwest corner of sec. 22, T. 79 N., R. 5 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 13 inches; grayish brown (10YR 5/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; friable; medium acid; clear smooth boundary.

B21tg—13 to 17 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; thin discontinuous clay films; medium acid; gradual smooth boundary.

B22tg—17 to 23 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine prominent strong brown (7.5YR 5/6) mottles; medium subangular blocky structure; firm; thin discontinuous clay films; strongly acid; gradual smooth boundary.

B23tg—23 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky and angular blocky; firm; thick continuous clay films; common dark iron and manganese concretions; strongly acid; gradual smooth boundary.

B31tg—30 to 36 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films; strongly acid; gradual smooth boundary.

B32tg—36 to 43 inches; light olive gray (5Y 6/2) silty clay loam; common medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; friable; thin discontinuous clay films; common fine dark iron and manganese concretions; slightly acid; diffuse smooth boundary.

B33g—43 to 56 inches; light olive gray (5Y 6/2) silty clay loam; common medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; friable; common dark iron and manganese concretions; slightly acid; diffuse smooth boundary.

C—56 to 60 inches; light olive gray (5Y 6/2) silt loam; common medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; massive; friable; common dark iron and manganese concretions; slightly acid.

The solum ranges from 50 to 70 inches in thickness.

The A1 or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. The A2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silt loam that ranges from 18 to 26 percent in content of clay. The A2 horizon ranges from 5 to 10 inches in thickness.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Mottles are of higher chroma. Clay content of the Bt horizon ranges from 32 to 38 percent, but the weighted clay average is less than 35 percent. Reaction is medium acid to strongly acid.

The C horizon typically is silt loam but is sandy loam in some pedons.

Watkins series

The Watkins series consists of well drained and moderately well drained, moderately permeable soils that formed in silty alluvium. These soils are on stream benches that lie a few feet above the flood plain. Native vegetation was prairie grasses and deciduous trees. Slopes range from 0 to 5 percent.

Watkins soils are commonly adjacent to Koszta, Tuskeego, and Whittier soils. Wiota soils have a thicker, dark A horizon than Watkins soils and do not have an A2 horizon. They are on low lying positions below the Watkins soils. Koszta soils are more poorly drained and slightly lower on the landscape. Tuskeego soils are poorly drained soils in slightly depressional areas. Whittier soils are underlain by sandy material at a shallower depth. They are in positions on the landscape similar to those of the Watkins soils.

Typical pedon of Watkins silt loam, 0 to 2 percent slopes, 2,040 feet south and 40 feet west of the northeast corner of sec. 1, T. 78 N., R. 7 W.

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; neutral; abrupt smooth boundary.

A2—7 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak thin platy structure; friable; neutral; clear smooth boundary.

B1—9 to 15 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

B21t—15 to 26 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; thin discontinuous clay films; light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; gradual smooth boundary.

B22t—26 to 33 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron concretions; strongly acid; gradual smooth boundary.

B31t—33 to 40 inches; brown (10YR 4/3) light silty clay loam; few fine faint yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; friable; few clay flows in root channels; light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron concretions; strongly acid; gradual smooth boundary.

B32t—40 to 48 inches; brown (10YR 5/3) silt loam; few fine faint yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; moderate fine prismatic structure; friable; few clay flows in root channels; few dark iron concretions; layer of loam at a depth of 41 to 43 inches; strongly acid; gradual smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4 and 5/6) silt loam; massive; friable; few clay flows in root channels; few dark iron concretions; layer of loam at a depth of 53 to 55 inches; strongly acid.

The solum typically is about 48 inches but ranges from 30 to 60 inches in thickness.

The A1 or Ap horizon is very dark gray (10YR 3/1) or dark grayish brown (10YR 3/2). The A2 horizon typically is dark grayish brown (10YR 4/2), but colors of 3 value are on coatings of peds. The A horizon is silt loam that ranges from 18 to 24 percent in content of clay.

The B horizon typically is brown (10YR 4/3), but chroma ranges from 3 through 4. The clay content of the upper 20 inches of the argillic horizon averages 30 to 35 percent. The C horizon typically is silt loam that has thin strata of loam and sandy loam. The B and C horizons range from medium acid to slightly acid.

Watseka series

The Watseka series consists of somewhat poorly drained, rapidly permeable soils on stream benches and uplands. These soils formed in sandy material deposited by wind or water. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Watseka soils are commonly adjacent to Marshan and Sparta soils. Marshan soils have more clay in the surface layer and subsoil than Watseka soils. They are poorly drained and are on low lying areas below the

Watseka soils. Sparta soils are better drained and generally occupy higher positions in the landscape.

Typical pedon of Watseka loamy fine sand, 0 to 2 percent slopes, 2,740 feet east and 420 feet north of the southwest corner of sec. 31, T. 81 N., R. 7 W.

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

A12—8 to 13 inches; very dark brown (10YR 2/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; clear smooth boundary.

A3—13 to 18 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slightly acid; clear smooth boundary.

B1—18 to 30 inches; dark grayish brown (10YR 4/2) loamy fine sand; common medium distinct grayish brown (10YR 5/2), brown (7.5YR 4/4), and strong brown (7.5YR 6/6) mottles; weak fine subangular blocky structure; very friable; slightly acid; gradual irregular boundary.

B2—30 to 36 inches; mottled dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6), light brownish gray (10YR 6/2), brown (7.5YR 4/4), and strong brown (7.5YR 5/6) loamy fine sand; weak coarse subangular blocky structure; very friable; slightly acid; clear wavy boundary.

C1—36 to 45 inches; grayish brown (2.5Y 5/2) loamy fine sand; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; single grain; loose; slightly acid; gradual wavy boundary.

C2—45 to 60 inches; grayish brown (2.5Y 5/2) sand; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; single grain; loose; slightly acid.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loamy fine sand or sand. The B horizon has hue of 10YR, 2.5Y, 5Y, or 7.5YR, value of 4 through 7, and chroma of 2 to 4 or 6 to 8. The C horizon has colors similar to those of the B horizon, but some pedons have chroma of 1. The B and C horizons are loamy fine sand or sand.

Waubeek series

The Waubeek series consists of moderately well drained and well drained, moderately permeable soils that formed in 24 to 40 inches of loess and underlying glacial till. These soils are in convex positions on uplands. Native vegetation was prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

Waubeek soils are commonly adjacent to Bassett, Franklin, Kenyon, Klinger, and Maxfield soils. Dinsdale soils have a thicker, dark A horizon than Waubeek soils. Bassett and Kenyon soils formed in loamy material and glacial till. They are on convex slopes below the Waubeek soils. Franklin and Klinger soils have grayer B horizons and are more poorly drained. They are on concave slopes below the Waubeek soils. Maxfield soils are poorly drained and are on broad, upland flats and in drainageways below the Waubeek soils.

Typical pedon of Waubeek silt loam, 2 to 5 percent slopes, 2,621 feet north and 690 feet west of the southeast corner of sec. 23, T. 80 N., R. 7 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure parting to weak fine granular; friable; neutral; clear smooth boundary.

B1t—12 to 17 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; thin discontinuous clay films; slightly acid; clear smooth boundary.

B21t—17 to 29 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky and angular blocky structure; friable; few dark iron concretions; few thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; thin discontinuous clay films; strongly acid; clear smooth boundary.

B22t—29 to 35 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky and angular blocky structure; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; abrupt smooth boundary.

IIB3t—35 to 43 inches; yellowish brown (10YR 5/6) loam; few medium faint grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure parting to moderate subangular blocky; firm; few thin discontinuous clay films; few dark iron concretions; few small pebbles; nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; strongly acid; gradual smooth boundary.

IIC1—43 to 56 inches; yellowish brown (10YR 5/6) loam; few fine faint distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure; firm; few small pebbles; common dark iron concretions; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

IIC2—56 to 60 inches; yellowish brown (10YR 5/6) loam; common medium faint grayish brown (10YR 5/2) mottles; massive; firm; common dark iron concretions; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid.

The solum ranges from 42 inches to about 60 inches in thickness.

The A1 or Ap horizon is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). It is 6 to 9 inches thick. The A2 horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3).

The upper part of the B horizon is silty clay loam that ranges from 27 to 34 percent in content of clay. It has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The lower part of the B horizon has hue of 10YR or 7.5YR, value or 4 or 5, and chroma of 4 to 8. It has few common low chroma mottles. The lower part of the B horizon ranges from loam or sandy clay loam to clay loam. Lenses of sandy loam or loamy sand as much as 10 inches thick are between the loess and the glacial till in places. Reaction is slightly acid to strongly acid in the lower part of the B horizon.

Waukee series

The Waukee series consists of well drained soils that formed in about 32 to 40 inches of loamy alluvial material underlain by sand and gravel. These soils are on stream benches and uplands. Permeability is moderate over rapid. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Waukee soils are similar to Sattre soils and are commonly adjacent to Flagler, Hoopeston, Lawler, and Marshan soils. Sattre soils have a thinner, dark surface layer than Waukee soils. Flagler soils are shallower to sand and gravel. Hoopeston, Lawler, and Marshan soils are more poorly drained and are grayer in the upper part of the B horizon. Flagler soils are in positions on the landscape similar to those of the Waukee soils. Hoopeston, Lawler, and Marshan soils are on lower lying areas.

Typical pedon of Waukee loam, 0 to 2 percent slopes, 1,380 feet west and 860 feet south of the northeast corner of sec. 22, T. 78 N., R. 6 W.

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

A12—7 to 11 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A13—11 to 19 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular and subangular blocky structure; friable; medium acid; gradual smooth boundary.

B1—19 to 24 inches; dark brown (10YR 3/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

B21—24 to 30 inches; brown (10YR 4/3) loam; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; friable; thin discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; medium acid; clear smooth boundary.

B22—30 to 38 inches; dark yellowish brown (10YR 4/4) loam; weak coarse prismatic structure parting to weak medium subangular blocky; friable; thin discontinuous dark yellowish brown (10YR 3/4) coatings on faces of peds; medium acid; gradual smooth boundary.

IIC1—38 to 46 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) loamy sand grading to fine sand; single grain; loose; 20 percent gravel; medium acid; clear smooth boundary.

IIC2—46 to 60 inches; yellowish brown (10YR 5/4) fine and medium sand; single grain; loose; 20 percent gravel; medium acid.

Thickness of the solum may or may not correspond to the depth to coarse loamy sand or gravelly sand.

The A1 or Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2). It is loam or silt loam and is high in content of sand. The A horizon ranges from 13 to 23 inches in thickness. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The B2 horizon is loam, sandy clay loam, or sandy loam. Clay content ranges from about 18 to 26 percent.

The C horizon is coarse loamy sand, gravelly sand, or medium sand. Gravel content is about 10 to 20 percent but may range to as much as 20 to 50 percent, by volume, in some places.

Waukegan series

The Waukegan series consists of well drained soils that formed in 24 to 40 inches of silty material and underlying sandy material. These soils are on stream benches and uplands. Native vegetation was prairie grasses. Permeability is moderate over rapid. Slopes range from 1 to 5 percent.

Waukegan soils are similar to Whittier soils and are commonly adjacent to Burkhardt, Raddle, Tama, and Whittier soils. Whittier soils have a thinner, dark A horizon than Waukegan soils. Burkhardt soils are shallower to sand and gravel. Raddle soils are deeper to sandy material. Tama soils formed in loess more than 40

inches thick. All of these soils are in positions on the landscape similar to those of the Waukegan soils.

Typical pedon of Waukegan silt loam, 1 to 5 percent slopes, 200 feet east and 140 feet south of the northwest corner of sec. 6, T. 81 N., R. 8 W.

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

A12—8 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry, very dark brown (10YR 2/2) kneaded; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A3—11 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; brown (10YR 4/3) mixing; very dark brown (10YR 2/2) coatings on faces of peds; weak fine granular and subangular blocky structure; friable; slightly acid; clear smooth boundary.

B21—14 to 22 inches; brown (10YR 4/3) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine and medium subangular blocky structure; friable; medium acid; clear wavy boundary.

B22t—22 to 31 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam; weak medium prismatic structure parting to weak fine and medium subangular blocky structure; friable; thin discontinuous clay films; medium acid; clear wavy boundary.

B3t—31 to 37 inches; dark yellowish brown (10YR 4/4) silty clay loam grading to loam; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; friable; few dark iron concretions; krotovina at a depth of 33 to 35 inches; medium acid; abrupt smooth boundary.

IIC1—37 to 43 inches; yellowish brown (10YR 5/6) gravelly loamy sand; single grain; loose; slightly acid; clear wavy boundary.

IIC2—43 to 60 inches; yellowish brown (10YR 5/6 and 5/8) sand; single grain; loose; slightly acid.

The solum ranges from 42 to about 60 inches in thickness. Depth to contrasting textures ranges from about 30 to 45 inches but in some places is as shallow as 24 inches.

The A1 or Ap horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2), and the A3 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). The A horizon ranges from 12 to 20 inches in thickness. The B2 horizon typically has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. The B horizon ranges from silty clay loam to silt loam. Reaction is neutral to strongly acid.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6.

Whittier series

The Whittier series consists of well drained soils that formed in about 24 to 40 inches of silty and loamy material overlying sandy material. These soils are on stream benches and uplands. Permeability is moderate over rapid. Native vegetation was prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

Whittier soils are similar to Waukegan soils and are commonly adjacent to Sattre, Watkins, and Waukegan soils. Waukegan soils have a thicker dark A horizon than Whittier soils. Sattre soils have more content of sand in the A and B horizons. Watkins soils are not underlain by sand and gravel. These soils are in positions on the landscape similar to the Whittier soils.

Typical pedon of Whittier silt loam, 2 to 5 percent slopes, 530 feet east and 105 feet south of the northwest corner of sec. 16, T. 81 N., R. 8 W.

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; neutral; abrupt smooth boundary.

A2—7 to 9 inches; brown (10YR 4/3) silt loam; weak thick platy structure parting to weak fine granular; friable; neutral; clear smooth boundary.

B1t—9 to 19 inches; dark yellowish brown (10YR 4/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate very fine and fine angular and subangular blocky structure; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; gradual smooth boundary.

B21t—19 to 25 inches; yellowish brown (10YR 5/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine angular and subangular blocky structure; friable; thin discontinuous clay films; thin nearly continuous light gray (10YR 7/2) dry silt coatings on faces of peds; slightly acid; gradual smooth boundary.

B22t—25 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine and medium angular and subangular blocky structure; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron concretions; strongly acid; gradual smooth boundary.

B3t—30 to 36 inches; yellowish brown (10YR 5/4) loam; brown (10YR 4/3) coatings on faces of peds; moderate medium prismatic structure parting to moderate coarse subangular blocky; friable; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) dry silt coatings on faces of peds; few dark iron concretions; strongly acid; abrupt wavy boundary.

IIC—36 to 60 inches; yellowish brown (10YR 5/4 and 5/6) and brownish yellow (10YR 6/6) medium sand; single grain; loose; 1/4-inch strong brown (7.5YR 5/6) iron bands at a depth of 41 inches and 50 inches; strongly acid.

The solum typically ranges from 30 to 48 inches in thickness, and in places this corresponds to the depth to loamy sand or sand. Depth to the sandy material typically is 30 to 40 inches but in places is as shallow as 24 inches.

The Ap or A1 horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. The A2 horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). It typically is about 2 to 5 inches thick.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam that ranges from about 32 to 35 percent in content of clay. Reaction is medium acid to strongly acid. The B3t horizon is loam or sandy loam.

The C horizon is sandy loam, loamy sand, or sand.

Wiota series

The Wiota series consists of well drained and moderately well drained, moderately permeable soils that formed in silty alluvium. These soils are on stream benches that lie a few feet above the flood plain. Native vegetation was prairie grasses. Slopes range from 1 to 3 percent.

Wiota soils are commonly adjacent to Nevin soils. Nevin soils are more poorly drained than Wiota soils and are slightly lower in the landscape.

Typical pedon of Wiota silt loam, 1 to 3 percent slopes, 800 feet north and 57 feet east of the southwest corner of sec. 4, T. 78 N., R. 6 W.

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

A12—7 to 14 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; gradual smooth boundary.

A13—14 to 20 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular and subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21t—20 to 27 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; thin discontinuous clay films; strongly acid; gradual smooth boundary.

B22t—27 to 37 inches; brown (10YR 4/3) silty clay loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; thin discontinuous clay films; few dark iron concretions; medium acid; gradual smooth boundary.

B3t—37 to 49 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films; few dark iron concretions; medium acid; gradual smooth boundary.

C—49 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; friable; thin discontinuous clay films; few dark iron concretions; slightly acid.

The solum ranges from 36 to 60 inches in thickness. The A horizon ranges from 18 to 32 inches in thickness.

The A horizon is silt loam or silty clay loam. Clay content of the A horizon ranges from 25 to 32 percent. The B2t horizon is silty clay loam that ranges from about 32 to 35 percent in content of clay.

The C horizon is silt loam or silty clay loam and is stratified in some pedons.

Zook series

The Zook series consists of poorly drained, slowly permeable soils on low flood plains that are commonly adjacent to foot slopes and bench escarpments. These soils formed in silty and clayey alluvium. Native vegetation was prairie grasses. Slopes range from 0 to 2 percent.

Zook soils are similar to Colo soils and are commonly adjacent to Bremer, Colo, Elvira, and Nevin soils. Colo soils have less clay content in the solum than Zook soils. Bremer soils have a thinner A horizon and less clay content in the B horizon. Elvira soils have a high concentration of iron and manganese. Nevin soils are better drained and are on high second bottoms and low stream benches above the Zook soils. Bremer, Colo, and Elvira soils are in positions on the landscape similar to those of the Zook soils.

Typical pedon of Zook silty clay loam, 0 to 2 percent slopes, 60 feet west and 660 feet north of the southeast corner of sec. 25, T. 77 N., R. 6 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular and subangular blocky structure; friable; neutral; clear smooth boundary.

A12—7 to 15 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A13—15 to 29 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; firm; neutral; gradual smooth boundary.

A3—29 to 39 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; firm; slightly acid; gradual smooth boundary.

Bg—39 to 53 inches; dark gray (10YR 4/1) silty clay; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; slightly acid; gradual smooth boundary.

Cg—53 to 60 inches; dark gray (5Y 4/1) and gray (5Y 5/1) silty clay loam; massive; firm; neutral.

The thickness of the solum ranges from about 36 to 64 inches. The thickness of the mollic epipedon ranges from 36 to 50 inches. The A horizon ranges from about 26 to 40 inches in thickness.

The A horizon is silty clay loam or silty clay. Reaction ranges from medium acid to neutral.

formation of the soils

In this section, factors that affected the formation of the soils in Johnson County are discussed. Also discussed is the classification of the soils by higher categories.

factors of soil formation

Soil is produced by the action of soil forming processes on material deposited or accumulated by geological forces (5). The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, (5) the length of time the forces of soil formation have acted on the soil material, and (6) man's influence on the soil.

Climate and vegetation are the active factors in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Time is needed for the changing of parent material into a soil profile. It may be much or little, but some time is required for horizon differentiation. A long period generally is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

parent material

The accumulation of parent material is the first step in the formation of a soil. Some of the soils in the county formed as the result of weathering of the bedrock. Most of the soils, however, formed in material that was transported from the site of the parent rock and redeposited at a new location through the action of glacial ice, water, wind, and gravity.

The principal parent materials in Johnson County are loess, glacial drift, alluvium, and eolian or wind-deposited sand. Much less extensive parent materials are organic deposits and residuum.

Loess is the most extensive parent material in Johnson County. It is windblown silt that mantles the glacial drift. Unweathered loess is silt loam and is calcareous. This material, which was deposited during the Wisconsin glacial stage, varies in thickness. In some areas of the county the loess is absent, or it is only 20 to 40 inches thick. The loess in the rest of the county ranges from about 10 to 30 feet in thickness.

The Tama, Otley, Fayette, Clinton, Muscatine, and Mahaska soils formed in areas where the loess is more than 40 inches thick. The Armstrong soils formed on side slopes where the loess is thin, and a paleosol may be exposed. The Gara or Lindley soils developed on the steeper side slopes where glacial till is exposed. Small areas where a paleosol or glacial till is exposed are shown on the map sheets by a special symbol.

The loess mantled Iowan erosion surface has areas where the loess covering is only 20 to 40 inches thick. These areas have been described as the "Iowan Drift" (*1*). Ruhe and his associates, however, showed that the "Iowan Drift" is, in fact, areas that have been eroded down to the Kansan and older drifts. They renamed the "Iowan Drift" the Iowan erosion surface complex (*14*). The Dinsdale, Klinger, Maxfield, and Waubeek soils formed in these areas.

Scattered throughout the northern part of the county are elongated ridges called "pahas" (*14, 17*). These loess-capped ridges, which are oriented from northwest to southeast, stand apart on the Iowan plain or merge with similar features to form long ridges of broad upland (fig. 15).

Glacial drift is rock material transported and deposited by glacial ice or running water derived from melting glacial ice and includes glacial till. Glacial till is unsorted sediment with particles ranging from boulders to clay (*12*). Glacial drift is the second most important parent material in the formation of the soils in Johnson County. At least twice during the Pleistocene Period continental glaciers moved over the land. The record of these ice invasions is contained in the unconsolidated rock material that was deposited by the melting ice and melt water streams. The first ice sheet, known as the Nebraskan, is more than 750,000 years of age. It was followed by the Aftonian interglacial period. The Kansan Glaciation is less than 600,000 years of age. A more recent glaciation was recognized by Leighton (*8*) as the "Iowan substage" of the Wisconsin glacial stage, but more recent studies of Iowan glacial till indicate that the

Figure 15.—This "paha" in the northern part of Johnson County is in Tama-Dickinson complex, 5 to 9 percent slopes, moderately eroded.

"Iowan Drift" does not exist (*14*). For this reason conclusions formed from studies made before 1960 are no longer considered valid. Intensive, detailed, geomorphic and stratigraphic work show that the landscape is a multilevel erosion surface, and that many of the levels are cut into Kansan and Nebraskan till. This surface is arranged in a series of steps from the major drainageways to the bordering divides. A stone line marks the boundary between the Iowan surface and the Kansan and Nebraskan till. It occurs on all levels of the stepped surfaces, and passes under the alluvium along the drainageways.

The Bassett and Kenyon soils formed in glacial drift and glacial till on the Iowan erosion surface. They have loamy surficial sediment 1 foot to 2 feet thick overlying the glacial material. A stone line or pebble band commonly separates the friable, loamy surficial sediment from the firm loam or clay loam glacial till.

Alluvium consists of sediment that has been transported and deposited by water. The alluvial deposits are of Late Wisconsin age and occur under the flood plains and terraces of water courses in Johnson County. The alluvial material consists of lenses and layers of

sand and gravel, silt, and clay. The thickness of this material is variable. Along major streams the material is very thick, but along the smaller streams it is less than 5 feet thick. The Waukee soil formed in loamy alluvium over sand and gravel, and the Raddle soil formed in silty material that has stratified sand at a depth of more than 4 feet.

Some alluvial material was transported only a short distance and accumulated at the foot of the slope where it originated. This material is called "local" alluvium and retains many characteristics of the soils in areas from which it eroded. The Ely soils are an example. They occur at the foot of slopes directly below loess-derived soils.

When streams overflow their channels and water spreads over the flood plains, coarse-textured materials are deposited first. As the floodwater continues to spread, it moves more slowly and fine-textured sediment, such as silt, is deposited. After the flood has passed, the finest particles, which are clay, settle from the water that is left standing in the lowest part of the flood plain. The Nodaway soils formed from silty material, and the Spillville soils formed from coarser textured, loamy, material. The Colo soils contain more clay because they are on the lowest part of the flood plain. They are silty clay loam.

At one time an old glacial lake may have existed in the southern part of Johnson County. Lake Calvin (*1, 15*) is the name given to an extensive lowland area which forms a distinctive topographic feature in the landscape of southeastern Iowa. This area includes portions of Louisa, Muscatine, Cedar, Washington, and Johnson Counties. Sharply defined bluffs outline most of the basin and mark an abrupt change from the rolling upland terrain to the level lowlands. The basin area is bounded on the north and west by uplands of loess-mantled Kansan glacial drift and on the east by uplands of loess-mantled Illinoian drift (*6, 7*). This lowland area has traditionally been interpreted as the site of a Pleistocene or glacial-age lake that formed along the ice margin as the Illinoian ice sheet advanced from the east and ponded the drainage water of the Mississippi, Maquoketa, Wapsipinicon, Cedar, and Iowa Rivers against the Kansan uplands to the west.

The lake basin is V-shaped, with the apex occurring at the junction of the Iowa and Cedar Rivers at Columbus Junction. One arm of the basin extends northeast along the Cedar River to the Wilton-Durant area, and the other arm extends northwest along the Iowa River as far as Iowa City. The basin itself, an erosional feature cut deeply into underlying, older glacial drift and sedimentary bedrock formations, is partially filled with sorted and stratified stream and lake deposits. Remnants of these deposits form broad, flat terrace surfaces throughout the lake basin. Abrupt scarps mark the differences in elevation among the terraces that were constructed during periods of former high water level and the present surface of the flood plain.

Three of these distinct terrace surfaces are within the basin. The high and low terraces generally are confined to the Iowa River segment, and an extensive intermediate terrace is present only in the Cedar River portion. Wisconsin age loess mantles the adjacent uplands and high and intermediate terrace surfaces; the low terrace, however, is not loess mantled. Subsurface studies show that this terrace sediment is made up of gravel, sand, silt, and clay and varies in thickness from 35 to 105 feet. This includes the loess cover. The flood plains bordering the Iowa and Cedar Rivers contain the overflow during flood periods and thus define the present level of erosion and deposition within the basin. The exposure of this area of waterlaid sediment to wind has resulted in the formation of sand dunes, some of which appear as isolated hummocks on terrace margins and others as undulating dune topography. This type of terrain is particularly well developed along the eastern margins of the Cedar River part of the basin.

The Iowa River valley is narrow in the vicinity of Iowa City but widens into broad, alluvial plains that extend southward into Louisa County. These plains, which are rich farmland, make up much of the acreage of Lucas, Pleasant Valley, and Fremont townships and are the largest part of Lake Calvin in Johnson County. Two of the three terrace surfaces, the high terrace and the low terrace (*16*), are most extensive within the county. The higher terrace is generally continuous on the east side of the river and in a few small areas on the west side. Sand dunes commonly occur along the terrace margins. The low terrace is restricted primarily to the Iowa River branch of the lake basin. This terrace, however, is not continuous and is found only as narrow, linear remnants. Isolated remnants of both terraces are within the tributary valley of Old Man Creek.

The uplands surrounding the lake basin consist of Wisconsin age loess. The loess is underlain by paleosols that developed in Kansan age glacial till. The two terraces within the basin consist of stratified, alluvial and lacustrine sediment. The high terrace is mantled with Wisconsin loess, but the low terrace has no loess cover.

The basin was first considered to be a lacustrine feature in 1894 by Samuel Calvin (*4*). In 1898, J. A. Udden named the basin for Calvin. Walter H. Schoewe produced the first and only major study of the Lake Calvin area in 1920 (*16*), although since that time several studies have been made relating to Lake Calvin (*11*). Radiocarbon dating, as well as the results of test drilling undertaken to determine the position of the Yarmouth-Sangamon paleosol surface, indicate that the Lake Calvin terraces are younger than Illinoian age and are probably of Wisconsin age. These studies fit the chronology of the Iowan erosion surface. Other test drilling demonstrated stratigraphic complexities within the basin which indicated the presence of both Illinoian and

Wisconsin sediment. Such investigations show a need for detailed reexamination of Lake Calvin, including systematic drilling to determine the complete sequence of sediments within the basin. Until more information is available, the basin remains an area of complex, stratigraphic and geomorphic relationships, relationships that hold a record of both alluvial and lacustrine environments and span a period of Pleistocene time that may include both Wisconsin and Illinoian glacial stages.

Eolian or wind-deposited sand occurs in uplands and on benches. In the glacial till uplands the sand is on low mounds or dunes and is underlain by till at varying depths. It is also in areas intermingled with loess soils. The wind-deposited sand, which consists largely of fine or very fine quartz particles, is highly resistant to weathering and has not changed appreciably since it was deposited. The Chelsea, Dickinson, Lamont, and Sparta soils formed mainly from wind-deposited sand.

Organic deposits consist of plant material that has accumulated in old lakebeds or swamps that at one time supported a thick growth of water-loving plants. The organic soils in Johnson County are in small wet areas where poor drainage has retarded the decay of plant remains. The thickness of this organic material ranges from about 10 to 60 inches. Houghton muck is an example of an organic soil.

Residuum is material derived from the weathering of sedimentary rock in place. It is a very small source of parent material in Johnson County. The underlying bedrock for most of the county belongs to the Devonian system (*9*). In the northeastern part of the county, however, the bedrock belongs to the Silurian system. These two systems are composed principally of limestone and dolomite with small amounts of shale. They generally slope about 20 feet per mile to the southwest.

climate

According to available evidence, the soils of Johnson County have been forming under the influence of a midcontinental, subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to the growth of forest vegetation (*10*). The morphology of most of the soils indicates that the climate under which the soils formed is similar to the present one. The present climate is fairly uniform throughout the county but is marked by wide seasonal extremes in temperature. Precipitation is distributed throughout the year.

Climate is a major factor in determining which soils are derived from plant material. The rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil are influenced by climate. Temperature, rain, relative humidity, and length of the frost-free period are important in determining the kind of vegetation.

The influence of the general climate of the region is somewhat modified by local conditions. For example, dry, sandy soils on south-facing slopes have a local climate or microclimate that is warmer and less humid than that of soils nearby.

Likewise, low lying, poorly drained soils are wetter and colder than most of the soils around them. These contrasting conditions account for some of the differences in soils within the same general climatic region.

plant and animal life

All living organisms are important to soil formation. These include vegetation, animals, bacteria, and fungi. Vegetation determines the content of organic matter, color of the surface layer, and content of nutrients. Animals, such as earthworms and burrowing animals, help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients for plant food.

Most soils in Johnson County formed under prairie grasses or a mixture of prairie grasses and water-tolerant plants. Because the grasses have many roots and tops that have decayed, the soils that developed have a thick, dark surface layer. The Muscatine and Tama soils are examples.

The soils that formed under trees have a thinner, lighter colored surface layer than soils that formed under grasses. The organic matter, derived principally from leaves, was deposited only on the surface layer of the soil. The Fayette and Lindley soils are examples.

In many areas the soils first formed under prairie grasses and then under forest vegetation. These soils are intermediate in color between the dark soils that formed entirely under grass and the light-colored soils that formed under trees. The Downs and Waubeek soils are examples.

The Downs, Fayette, and Tama soils are among a group of soils that formed in similar parent material and under comparable environment except for native vegetation. Differences in native vegetation account for the main differences in morphology in the soils of this group.

relief

Relief, or topography, influences soil formation mainly through its effect on drainage, runoff, and erosion. In Johnson County, relief ranges from nearly level to very steep. Water soaks into the nearly level soils in areas that are not flooded. Where the slope is steeper, more water runs off the surface layer and less water penetrates the soil. The Tama, Muscatine, and Garwin soils are examples of soils that formed in similar parent material under similar vegetation but differ because of topographic position. The Tama soils are gently sloping to strongly sloping on uplands. The Muscatine soils are on nearly level ridges and long, slightly concave slopes.

The Garwin soils are level or nearly level on broad, high upland flats.

In depressions where water is collected and impounded the soils are poorly drained and have a distinct, light colored subsurface layer and a gray subsoil. The Sperry soils are examples of soils that formed in depressions.

Soils that are steeply sloping have weak soil formation. Most of the water that falls on these soils runs off. Soils in areas of Rock outcrop are an example.

Soils that formed in alluvium are on bottom lands. Although they are nearly level, microrelief affects runoff, depth to water table, and the amount of new sediment deposited. Colo and Spillville soils are examples. The Colo soils are at a low elevation, are poorly drained, have a high water table, and impound water for short periods. The Spillville soils are at a slightly higher elevation and are moderately well drained to somewhat poorly drained.

Aspect, as well as gradient, has a significant influence on soil formation. Because south-facing slopes generally are warmer and drier than north-facing slopes, the kind and amount of vegetation is different.

The influence of porous, rapidly permeable parent material may override the influence of topography. The nearly level to moderately steep Sparta soils, for example, are excessively drained because they have very rapid permeability.

time

The length of time that the soil material remains in place and is acted on by the soil forming processes affects the kind of soil that forms. Older or more strongly developed soils show well defined genetic horizons. The Downs, Fayette, and Tama soils are examples. A less developed soil shows weakly developed horizons. Some soils that formed in alluvium show little or no profile development because fresh material is deposited periodically. This material has not been in place long enough for the climate and vegetation to produce well defined genetic horizons in the profile. The Nodaway soil is an example of a very young soil. In steep areas, the soil material is removed before it has had time to develop a deep soil profile. Rock outcrop is an example.

Resistance of material can also modify the effect of time upon soil formation. Soils that formed in material resistant to weathering, such as quartz sand, do not change much with the passage of time. The Chelsea and Sparta soils are examples.

Where organic material has been buried by later deposition through the action of ice, water, or wind, the age of a landscape can be determined by a process known as radiocarbon dating (*13*).

The Downs, Fayette, and Tama soils formed in loess that is probably 14,000 to 20,000 years of age. Recent studies (*14*) show that the Iowan erosion surface formed during the time of loess deposition. The Iowan surface underlying the loess could be as young as 14,000 years of age, which dates the end of the major loess deposition in Iowa, and the surface not covered by loess also could be younger than the loess. The Iowan surface, where it is covered by loam surficial sediment, is younger than 14,000 years, and soils on the slopes are probably much younger. The Bassett and Kenyon soils are examples of soils on the surface.

man's influence on the soil

Important changes took place when Johnson County was settled. Some changes had little effect on soil productivity, but other changes had drastic effects.

Most important are the changes caused by water erosion. Cultivation changes the soil by making sloping areas more susceptible to erosion. Erosion removes topsoil, organic matter, and plant nutrients. Sheet erosion, which is very prevalent in Johnson County, removes a few inches of topsoil at a time, but cultivation generally destroys all evidence of this loss. In other places shallow and deep gullies are formed and eroded material is deposited on the lower slopes.

If man cultivates the soil, soil blowing becomes an active threat. The light-textured soils are subject to blowing, especially when the soils are left bare and the topsoil is dry. On nearly level fields that have been plowed in the fall, dark topsoil can be seen mixed with the snow or piled along the fencerows and road ditches.

In fields that have been continuously cultivated, the well-developed granular structure that is characteristic of the surface layer in virgin grassland breaks down. The surface soil then tends to bake and becomes hard when dry. Fine textured soils that have been plowed continuously when wet tend to puddle and are less permeable than similar soils in undisturbed areas. In some fields of finer textured soils, a compacted layer that hardens on drying and is less permeable than the subsoil forms below the plowed layer. This layer is called a plowsole, or plowpan.

Man also has done much to increase soil productivity and to reclaim areas that are not suitable for crops. He has established drainage ditches and diversions at the foot of slopes to prevent flooding of lowlands. These areas can then be used for cultivated crops. In some areas he has applied commerical fertilizers to counteract deficiencies in plant nutrients and has made the soil more productive than the virgin soil. In many places dark, low lying soils have received lighter colored deposition.

Arenzville silt loam, a soil that formed in recent alluvium, shows the influence of man on the soils in Johnson County. Strata of dark and light colored material have washed from the hillsides and deposited during flooding over the original, dark soil. This erosion is the result of cultivating the hillsides.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

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.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils 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—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compact layers to depths 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 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.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil 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 are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. 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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.
Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.
Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.
Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Drainage, surface. Runoff, or surface flow of water, from an area.

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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

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 the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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 up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

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 upper case letter represents the major horizons. Numbers or lower case 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 at the surface of a mineral soil.

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.

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. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

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 A or B horizon. 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, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

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.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

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.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

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.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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. Mottling generally indicates poor aeration and impeded drainage. 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 colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

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.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

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 downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. 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.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly 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

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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.

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.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. 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.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

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.

Slow intake (in tables). The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
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 and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. The part of the soil below the solum.

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 horizon. This includes all subdivisions of the horizon (A1, A2, and A3 horizons).

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.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

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.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-73 at Iowa City, Iowa]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	29.7	10.8	20.3	56	-20	0	1.07	0.37	1.63	3	6.2
February	35.5	16.4	26.0	60	-15	0	1.07	.40	1.61	3	5.8
March	45.9	25.5	35.7	77	0	31	2.36	1.01	3.45	5	7.3
April	62.5	38.8	50.7	86	20	108	3.71	2.29	4.97	7	1.2
May	73.8	49.2	61.5	91	31	366	3.98	2.35	5.43	7	.0
June	82.9	59.2	71.1	96	42	633	4.25	1.73	6.29	6	.0
July	86.1	63.2	74.7	98	48	766	5.05	2.72	6.95	7	.0
August	85.1	61.0	73.0	97	46	713	3.03	1.37	4.38	5	.0
September	77.6	52.5	65.1	95	33	453	3.66	1.35	5.52	6	.0
October	67.4	42.0	54.7	88	21	211	2.62	.57	4.24	5	.2
November	49.6	29.0	39.3	73	6	9	1.85	.60	2.84	3	1.1
December	35.3	17.9	26.6	63	-15	0	1.49	.61	2.19	4	6.9
Yearly:											
Average	61.0	38.8	49.9	---	---	---	---	---	---	---	---
Extreme	---	---	---	99	-20	---	---	---	---	---	---
Total	---	---	---	---	---	3,290	34.14	27.19	40.73	61	28.7

[1]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° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-73 at Iowa City, 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--	April 15	April 30	May 9
2 years in 10 later than--	April 11	April 25	May 3
5 years in 10 later than--	April 3	April 15	April 23
First freezing temperature in fall:			
1 year in 10 earlier than--	October 16	October 9	September 25
2 years in 10 earlier than--	October 21	October 14	September 30
5 years in 10 earlier than--	October 31	October 25	October 10

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-73 at Iowa City, 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	167	145
8 years in 10	198	176	154
5 years in 10	210	192	169
2 years in 10	222	209	185
1 year in 10	229	218	193

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
7	Wiota silt loam, 1 to 3 percent slopes	635	0.2
11B	Colo-Ely complex, 2 to 5 percent slopes	18,675	4.8
41	Sparta loamy fine sand, 0 to 2 percent slopes	1,715	0.4
41B	Sparta loamy fine sand, 2 to 5 percent slopes	2,075	0.5
41C	Sparta loamy fine sand, 5 to 9 percent slopes	1,175	0.3
41D	Sparta loamy fine sand, 9 to 18 percent slopes	440	0.1
43	Bremer silty clay loam, 0 to 2 percent slopes	1,220	0.3
54	Zook silty clay loam, 0 to 2 percent slopes	1,225	0.3
63B	Chelsea loamy fine sand, 2 to 5 percent slopes	445	0.1
63C	Chelsea loamy fine sand, 5 to 9 percent slopes	680	0.2
63E	Chelsea loamy fine sand, 9 to 18 percent slopes	1,160	0.3
65D2	Lindley loam, 9 to 14 percent slopes, moderately eroded	675	0.2
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	1,850	0.5
65F	Lindley loam, 18 to 25 percent slopes	595	0.2
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded	330	0.1
75	Givin silt loam, 0 to 2 percent slopes	1,000	0.3
76B	Ladoga silt loam, 2 to 5 percent slopes	7,725	1.9
76C2	Ladoga silt loam, 5 to 9 percent slopes, moderately eroded	7,575	1.9
76D2	Ladoga silt loam, 9 to 14 percent slopes, moderately eroded	3,275	0.8
80B	Clinton silt loam, 2 to 5 percent slopes	3,600	0.9
80C	Clinton silt loam, 5 to 9 percent slopes	725	0.2
80C2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded	6,850	1.7
80D	Clinton silt loam, 9 to 14 percent slopes	450	0.1
80D2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded	4,405	1.1
80D3	Clinton silty clay loam, 9 to 14 percent slopes, severely eroded	2,325	0.6
83B	Kenyon loam, 2 to 5 percent slopes	1,875	0.5
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	2,075	0.5
88	Nevin silty clay loam, 0 to 2 percent slopes	1,180	0.3
110B	Lamont fine sandy loam, 2 to 5 percent slopes	725	0.2
110C	Lamont fine sandy loam, 5 to 9 percent slopes	925	0.2
110E	Lamont fine sandy loam, 9 to 18 percent slopes	365	0.1
118	Garwin silty clay loam, 0 to 2 percent slopes	4,800	1.2
119	Muscatine silt loam, 0 to 2 percent slopes	10,300	2.6
119B	Muscatine silt loam, 2 to 5 percent slopes	2,735	0.7
120B	Tama silt loam, 2 to 5 percent slopes	29,800	7.6
120C	Tama silt loam, 5 to 9 percent slopes	1,755	0.4
120C2	Tama silt loam, 5 to 9 percent slopes, moderately eroded	7,850	2.0
120D2	Tama silt loam, 9 to 14 percent slopes, moderately eroded	2,395	0.6
122	Sperry silt loam, 0 to 1 percent slopes	5,825	1.5
133	Colo silty clay loam, 0 to 2 percent slopes	5,100	1.3
133+	Colo silt loam, overwash, 0 to 2 percent slopes	6,525	1.6
135	Coland silty clay loam, 0 to 2 percent slopes	2,240	0.6
140	Sparta loamy fine sand, thick surface, 0 to 2 percent slopes	1,825	0.5
141	Watseka loamy fine sand, 0 to 2 percent slopes	780	0.2
152	Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,045	0.3
160	Walford silt loam, 0 to 1 percent slopes	4,175	1.1
161	Walford-Atterberry silt loams, 1 to 3 percent slopes	1,070	0.3
162B	Downs silt loam, 2 to 5 percent slopes	3,585	0.9
162C	Downs silt loam, 5 to 9 percent slopes	845	0.2
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	10,550	2.7
162D2	Downs silt loam, 9 to 14 percent slopes, moderately eroded	6,750	1.7
163B	Fayette silt loam, 2 to 5 percent slopes	5,925	1.5
163C	Fayette silt loam, 5 to 9 percent slopes	3,925	1.0
163C2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	10,070	2.5
163D	Fayette silt loam, 9 to 14 percent slopes	2,175	0.5
163D2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	6,895	1.7
163D3	Fayette silty clay loam, 9 to 14 percent slopes, severely eroded	5,425	1.4
163E	Fayette silt loam, 14 to 18 percent slopes	1,305	0.3
163E2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	5,575	1.4
163E3	Fayette silty clay loam, 14 to 18 percent slopes, severely eroded	7,600	1.9
163F	Fayette silt loam, 18 to 25 percent slopes	3,575	0.9
163F2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	5,225	1.3
163G	Fayette silt loam, 25 to 40 percent slopes	7,550	1.9
165	Stronghurst silt loam, 0 to 2 percent slopes	275	0.1
171B	Bassett loam, 2 to 5 percent slopes	800	0.2
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	3,250	0.8
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded	1,350	0.3
171D3	Bassett loam, 9 to 14 percent slopes, severely eroded	495	0.1
173	Hoopeston fine sandy loam, 0 to 2 percent slopes	355	0.1
174B	Bolan loam, 2 to 5 percent slopes	605	0.2
175	Dickinson fine sandy loam, 0 to 2 percent slopes	250	*
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	845	0.2

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	315	0.1
178	Waukee loam, 0 to 2 percent slopes	2,795	0.7
179D2	Gara loam, 9 to 14 percent slopes, moderately eroded	975	0.2
179E2	Gara loam, 14 to 18 percent slopes, moderately eroded	800	0.2
184	Klinger silty clay loam, 1 to 3 percent slopes	5,525	1.4
220	Nodaway silt loam, 0 to 2 percent slopes	4,550	1.1
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,480	0.4
279	Taintor silty clay loam, 0 to 2 percent slopes	565	0.1
280	Mahaska silty clay loam, 0 to 2 percent slopes	2,040	0.5
281B	Otley silty clay loam, 2 to 5 percent slopes	2,360	0.6
281C2	Otley silty clay loam, 5 to 9 percent slopes, moderately eroded	2,195	0.6
281D2	Otley silty clay loam, 9 to 14 percent slopes, moderately eroded	680	0.2
284	Flagler sandy loam, 0 to 2 percent slopes	195	*
285C	Burkhardt sandy loam, 5 to 9 percent slopes	875	0.2
291	Atterberry silt loam, 0 to 2 percent slopes	5,825	1.5
291B	Atterberry silt loam, 2 to 5 percent slopes	290	0.1
293C	Chelsea-Lamont-Fayette complex, 5 to 9 percent slopes	1,075	0.3
293C2	Chelsea-Lamont-Fayette complex, 5 to 9 percent slopes, moderately eroded	2,085	0.5
293D	Chelsea-Lamont-Fayette complex, 9 to 14 percent slopes	685	0.2
293D2	Chelsea-Lamont-Fayette complex, 9 to 14 percent slopes, moderately eroded	2,305	0.6
293E	Chelsea-Lamont-Fayette complex, 14 to 18 percent slopes	1,405	0.4
293E2	Chelsea-Lamont-Fayette complex, 14 to 18 percent slopes, moderately eroded	1,865	0.5
293F	Chelsea-Lamont-Fayette complex, 18 to 25 percent slopes	1,510	0.4
293G	Chelsea-Lamont-Fayette complex, 25 to 40 percent slopes	1,835	0.5
320	Arenzville silt loam, 0 to 2 percent slopes	2,775	0.7
350B	Waukegan silt loam, 1 to 5 percent slopes	1,050	0.3
352B	Whittier silt loam, 2 to 5 percent slopes	990	0.2
352C2	Whittier silt loam, 5 to 9 percent slopes, moderately eroded	625	0.2
377B	Dinsdale silty clay loam, 2 to 5 percent slopes	8,150	2.1
377C2	Dinsdale silty clay loam, 5 to 9 percent slopes, moderately eroded	1,075	0.3
382	Maxfield silty clay loam, 0 to 2 percent slopes	2,400	0.6
420B	Tama silt loam, benches, 2 to 5 percent slopes	625	0.2
422	Amana silt loam, 0 to 2 percent slopes	1,300	0.3
428B	Ely silt loam, 2 to 5 percent slopes	1,595	0.4
430	Ackmore silt loam, 0 to 2 percent slopes	2,250	0.6
442B	Tama-Dickinson complex, 2 to 5 percent slopes	1,300	0.3
442C2	Tama-Dickinson complex, 5 to 9 percent slopes, moderately eroded	1,725	0.4
442D2	Tama-Dickinson complex, 9 to 14 percent slopes, moderately eroded	535	0.1
453	Tuskeego silt loam, 0 to 2 percent slopes	1,200	0.3
484	Lawson silt loam, 0 to 2 percent slopes	2,560	0.6
485	Spillville loam, 0 to 2 percent slopes	2,260	0.6
520	Coppock silt loam, 0 to 2 percent slopes	1,615	0.4
539	Perks sandy loam, 0 to 2 percent slopes	400	0.1
621	Houghton muck, 0 to 2 percent slopes	150	*
687	Watkins silt loam, 0 to 2 percent slopes	390	0.1
687B	Watkins silt loam, 2 to 5 percent slopes	255	*
688	Koszta silt loam, 0 to 2 percent slopes	1,375	0.3
727	Udolpho loam, 0 to 2 percent slopes	2,595	0.7
729B	Nodaway-Arenzville silt loams, 1 to 4 percent slopes	6,275	1.6
760	Ansgar silt loam, 0 to 3 percent slopes	1,030	0.3
761	Franklin silt loam, 1 to 3 percent slopes	1,800	0.5
771B	Waubeek silt loam, 2 to 5 percent slopes	1,150	0.3
771C2	Waubeek silt loam, 5 to 9 percent slopes, moderately eroded	500	0.1
778	Sattre loam, 0 to 2 percent slopes	495	0.1
778B	Sattre loam, 2 to 5 percent slopes	425	0.1
792D2	Armstrong loam, 9 to 14 percent slopes, moderately eroded	445	0.1
793	Bertrand silt loam, 1 to 3 percent slopes	1,495	0.4
826	Rowley silt loam, 0 to 2 percent slopes	935	0.2
876B	Ladoga silt loam, benches, 2 to 5 percent slopes	1,350	0.3
920	Tama silt loam, sandy substratum, 0 to 2 percent slopes	300	0.1
920B	Tama silt loam, sandy substratum, 2 to 5 percent slopes	487	0.1
962	Elvira silty clay loam, 0 to 2 percent slopes	1,355	0.3
974B	Bolan loam, loamy substratum, 2 to 5 percent slopes	535	0.1
976	Raddle silt loam, 1 to 3 percent slopes	970	0.2
993D2	Gara-Armstrong loams, 9 to 14 percent slopes, moderately eroded	820	0.2
993E2	Gara-Armstrong loams, 14 to 18 percent slopes, moderately eroded	1,010	0.3
1119	Muscatine silt loam, benches, 0 to 2 percent slopes	415	0.1
1160	Walford silt loam, benches, 0 to 1 percent slopes	625	0.2
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes	2,575	0.6
1280	Mahaska silty clay loam, benches, 0 to 2 percent slopes	225	*

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
1291	Atterberry silt loam, benches, 0 to 2 percent slopes	1,525	0.4
1315	Perks-Spillville complex, 0 to 2 percent slopes	4,055	1.0
1316	Fluvaquents, ponded	5,970	1.4
1484	Lawson silt loam, channeled, 0 to 2 percent slopes	1,670	0.4
1485	Spillville loam, channeled, 0 to 2 percent slopes	1,175	0.3
2422	Amana-Lawson-Perks complex, 0 to 2 percent slopes	4,575	1.2
5010	Pits, sand and gravel	110	*
5030	Pits, limestone quarry	205	*
5040	Orthents, loamy	1,525	0.4
	Water	5,995	1.5
	Total	396,837	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*	AUM*	AUM*
7---------- Wiota	110	42	62	4.6	6.5	4.2	7.6
11B---------- Colo-Ely	105	38	80	4.1	6.8	4.0	7.2
41---------- Sparta	55	24	50	2.5	3.8	2.0	3.8
41B---------- Sparta	50	22	40	2.5	3.5	2.0	3.6
41C---------- Sparta	45	20	35	2.2	3.2	2.0	3.3
41D---------- Sparta	---	---	30	2.0	2.8	1.4	3.0
43---------- Bremer	106	40	58	4.5	6.3	4.0	7.5
54---------- Zook	96	36	72	4.0	4.0	4.0	6.0
63B---------- Chelsea	57	21	42	2.0	3.3	2.0	3.3
63C---------- Chelsea	52	20	39	1.8	3.0	1.8	3.0
63E---------- Chelsea	---	---	---	1.3	2.1	1.1	2.1
65D2---------- Lindley	65	24	41	2.9	5.8	2.4	5.0
65E2---------- Lindley	---	---	---	1.5	3.0	1.5	3.8
65F, 65F2---------- Lindley	---	---	---	---	2.0	1.1	2.0
75---------- Givin	119	45	65	5.0	8.3	4.2	8.3
76B---------- Ladoga	113	43	62	4.7	6.8	4.3	7.8
76C2---------- Ladoga	105	40	57	4.4	6.3	3.9	7.3
76D2---------- Ladoga	96	36	53	4.0	5.7	3.7	6.6
80B---------- Clinton	107	41	59	4.5	6.4	4.0	7.5
80C---------- Clinton	102	39	56	4.3	6.1	3.8	7.1
80C2---------- Clinton	99	38	54	4.2	6.0	3.6	7.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*	AUM*	AUM*
80D---------- Clinton	93	35	51	3.9	5.6	3.6	6.5
80D2---------- Clinton	90	34	50	3.8	5.3	3.5	6.3
80D3---------- Clinton	84	32	46	3.6	5.0	2.8	6.0
83B---------- Kenyon	113	43	90	4.7	6.6	4.2	7.8
83C2---------- Kenyon	105	40	84	4.4	6.3	3.8	7.3
88---------- Nevin	114	43	63	4.8	8.0	4.0	8.0
110B---------- Lamont	69	26	52	2.5	3.5	2.3	4.1
110C---------- Lamont	64	24	48	2.3	3.3	2.1	3.8
110E---------- Lamont	---	---	---	1.8	2.5	1.8	3.0
118---------- Garwin	125	47	94	5.0	7.5	4.1	8.3
119---------- Muscatine	131	50	98	5.5	7.8	4.2	9.1
119B---------- Muscatine	129	49	96	5.5	7.6	4.2	9.1
120B---------- Tama	125	48	95	5.2	7.5	4.2	8.6
120C---------- Tama	120	46	90	5.0	7.1	4.0	8.3
120C2---------- Tama	117	44	88	4.9	7.0	3.8	8.1
120D2---------- Tama	108	41	81	4.5	6.3	3.3	7.5
122---------- Sperry	97	37	53	3.5	5.1	3.6	7.7
133---------- Colo	104	40	78	4.2	5.5	4.2	7.0
133+---------- Colo	106	40	80	4.2	5.5	3.0	6.5
135---------- Coland	110	42	83	4.6	6.0	4.1	7.6
140---------- Sparta	55	35	50	2.5	4.0	2.0	4.0
141---------- Watseka	92	31	62	3.7	5.0	2.8	6.2
152---------- Marshan	95	35	70	4.0	5.5	4.2	6.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*	AUM*	AUM*
160---------- Walford	99	38	75	3.5	5.1	3.0	5.8
161---------- Walford-Atterberry	115	40	78	4.1	6.1	3.8	6.3
162B---------- Downs	119	45	95	5.0	7.1	4.1	8.3
162C---------- Downs	114	43	91	4.8	6.8	4.0	8.1
162C2---------- Downs	111	42	89	4.7	6.6	3.8	7.8
162D2---------- Downs	102	39	82	4.3	6.1	3.6	7.1
163B---------- Fayette	113	43	90	4.7	6.6	4.0	7.8
163C---------- Fayette	108	41	86	4.5	6.5	3.8	7.5
163C2---------- Fayette	105	40	84	4.4	6.5	3.6	7.5
163D, 163D2---------- Fayette	99	38	80	4.2	6.0	3.6	7.0
163D3---------- Fayette	90	34	72	3.8	5.3	3.5	6.3
163E, 163E2---------- Fayette	84	32	67	3.5	5.0	3.3	5.8
163E3---------- Fayette	---	---	62	3.2	4.5	3.0	5.3
163F---------- Fayette	---	---	60	3.4	4.8	3.1	5.6
163F2---------- Fayette	---	---	---	3.0	4.2	2.5	4.6
163G---------- Fayette	---	---	---	3.0	4.2	3.0	5.0
165---------- Stronghurst	138	42	76	5.3	6.2	4.6	7.5
171B---------- Bassett	107	40	85	4.5	6.5	4.0	7.5
171C2---------- Bassett	99	38	80	4.0	6.0	3.5	6.6
171D2---------- Bassett	90	34	72	3.8	5.3	3.2	6.3
171D3---------- Bassett	84	32	67	3.5	5.0	5.8	3.0
173---------- Hoopeston	105	33	70	4.1	6.0	3.8	6.8
174B---------- Bolan	88	33	70	3.7	5.2	3.6	6.1

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*	AUM*	AUM*
175---------- Dickinson	83	32	62	3.0	5.0	2.7	5.0
175B---------- Dickinson	81	31	60	3.0	4.8	2.7	5.0
175C---------- Dickinson	76	29	57	2.8	4.5	2.5	4.6
178---------- Waukee	98	37	78	4.1	5.8	4.0	6.8
179D2---------- Gara	75	28	41	3.1	4.5	2.5	5.1
179E2---------- Gara	---	---	35	2.2	3.6	1.5	3.8
184---------- Klinger	125	47	93	5.2	7.5	4.2	8.6
220---------- Nodaway	110	42	60	4.6	6.5	4.0	7.6
226---------- Lawler	100	38	80	4.2	7.0	4.0	7.8
279---------- Taintor	117	44	64	4.7	7.0	4.2	7.8
280---------- Mahaska	125	48	69	5.2	7.5	4.5	8.6
281B---------- Otley	119	45	65	5.0	7.1	4.3	8.3
281C2---------- Otley	111	42	61	4.7	6.6	3.9	7.8
281D2---------- Otley	102	39	56	4.3	6.1	3.7	7.1
284---------- Flagler	72	27	58	3.0	4.3	2.3	5.0
285C---------- Burkhardt	60	---	50	3.0	4.5	1.5	5.1
291---------- Atterberry	149	44	85	5.6	7.4	5.0	8.6
291B---------- Atterberry	148	44	84	5.5	7.3	4.8	8.4
293C---------- Chelsea-Lamont-Fayette	74	29	57	2.9	4.2	2.6	4.8
293C2---------- Chelsea-Lamont-Fayette	73	28	57	2.9	4.2	2.5	4.8
293D---------- Chelsea-Lamont-Fayette	66	25	52	2.5	3.6	2.3	4.1
293D2---------- Chelsea-Lamont-Fayette	63	24	50	2.4	3.3	2.3	3.9
293E---------- Chelsea-Lamont-Fayette	---	---	---	1.9	2.9	1.9	3.1

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*	AUM*	AUM*
293E2---- Chelsea-Lamont-Fayette	---	---	---	1.8	2.7	1.8	2.9
293F---- Chelsea-Lamont-Fayette	---	---	---	1.7	2.5	1.7	2.8
293G---- Chelsea-Lamont-Fayette	---	---	---	---	1.2	1.0	1.4
320---- Arenzville	120	46	80	---	6.5	5.0	8.6
350B---- Waukegan	95	30	75	4.0	5.9	3.2	5.6
352B, 352C2---- Whittier	83	31	67	3.5	5.0	3.3	5.8
377B---- Dinsdale	119	45	89	5.0	7.1	4.1	8.3
377C2---- Dinsdale	111	42	83	4.6	6.6	3.8	7.6
382---- Maxfield	119	45	89	5.0	6.6	4.2	8.3
420B---- Tama	125	48	95	5.2	7.5	4.2	8.6
422---- Amana	110	42	60	4.6	6.6	4.1	7.6
428B---- Ely	124	47	93	5.3	7.5	4.0	8.8
430---- Ackmore	110	42	80	4.4	4.8	2.8	7.0
442B---- Tama-Dickinson	87	33	65	3.5	5.8	2.9	6.1
442C2---- Tama-Dickinson	81	30	60	3.2	5.3	2.6	5.8
442D2---- Tama-Dickinson	74	28	55	2.8	4.7	2.2	5.1
453---- Tuskeego	88	31	45	3.3	4.3	3.3	5.5
484---- Lawson	130	---	80	5.5	7.3	5.0	8.6
485---- Spillville	122	46	98	5.1	7.3	4.2	8.6
520---- Coppock	89	34	49	3.7	4.7	3.3	6.1
539---- Perks	62	19	30	2.3	2.4	1.9	3.9
621---- Houghton	115	34	---	---	---	---	---
687---- Watkins	105	40	58	4.4	6.3	3.7	7.3

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*	AUM*	AUM*
687B---------- Watkins	103	39	56	4.3	6.1	3.7	7.1
688---------- Koszta	108	41	59	4.5	6.5	3.7	7.5
727---------- Udolpho	80	27	70	3.5	5.5	4.0	5.0
729B---------- Nodaway-Arenzville	115	---	69	4.8	6.9	4.4	7.7
760---------- Ansgar	93	35	74	3.7	5.5	6.1	6.1
761---------- Franklin	119	45	89	5.0	7.1	4.1	8.3
771B---------- Waubeek	113	43	85	4.7	6.8	4.0	7.8
771C2---------- Waubeek	105	40	79	4.4	6.3	3.7	7.3
778---------- Sattre	93	35	75	3.9	5.5	3.7	6.5
778B---------- Sattre	91	34	73	3.8	5.3	3.5	6.3
792D2---------- Armstrong	50	19	28	2.0	2.7	1.7	3.3
793---------- Bertrand	125	48	80	5.5	7.6	4.0	8.8
826---------- Rowley	135	52	80	5.5	7.6	4.6	8.9
876B---------- Ladoga	113	43	62	4.7	6.8	4.3	7.8
920---------- Tama	122	46	92	5.1	7.3	2.9	8.5
920B---------- Tama	120	45	90	5.0	7.1	2.9	8.3
962---------- Elvira	90	34	68	3.8	5.5	3.6	6.3
974B---------- Bolan	100	38	83	4.2	5.9	3.9	7.0
976---------- Raddle	149	45	83	5.8	7.9	4.4	8.9
993D2---------- Gara-Armstrong	65	25	36	2.7	3.8	2.2	4.4
993E2---------- Gara-Armstrong	---	---	---	1.9	2.7	1.4	3.2
1119---------- Muscatine	131	50	98	5.5	7.8	4.2	9.1
1160---------- Walford	99	38	75	3.5	5.1	3.0	5.8

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
	Bu	Bu	Bu	Ton	AUM*	AUM*	AUM*
1220---------- Nodaway	---	---	---	3.0	5.5	4.0	7.6
1280---------- Mahaska	125	48	69	5.2	7.5	4.5	8.6
1291---------- Atterberry	149	44	85	5.6	7.4	5.0	8.6
1315---------- Perks-Spillville	---	---	---	3.5	4.5	2.9	5.9
1316**. Fluvaquents							
1484---------- Lawson	---	---	---	---	---	3.0	---
1485---------- Spillville	---	---	---	---	---	3.8	---
2422---------- Amana-Lawson-Perks	---	---	---	---	---	3.0	---
5040**. Orthents							

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	37,235	---	---	---
II	156,192	79,887	69,315	6,990
III	113,990	97,210	15,805	975
IV	33,080	24,290	---	8,790
V	5,420	---	5,420	---
VI	25,295	23,695	---	1,600
VII	12,495	11,820	675	---
VIII	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available. The symbol > means more than]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
41, 41B, 41C, 41D--Sparta	3s	Slight	Slight	Severe	Slight	Northern red oak---- Red pine---------- Eastern white pine-- Jack pine----------	70 --- --- ---	Eastern white pine, red pine.
63B, 63C----------Chelsea	3s	Slight	Slight	Moderate	Slight	White oak---------- Red pine---------- Eastern white pine-- Jack pine---------- Quaking aspen------- Northern red oak----	70 72 83 70 72 70	Eastern white pine, red pine.
63E----------Chelsea	3s	Moderate	Moderate	Moderate	Slight	White oak---------- Red pine---------- Eastern white pine-- Jack pine---------- Quaking aspen------- Northern red oak----	70 72 83 70 72 70	Eastern white pine, red pine.
65D2----------Lindley	5o	Slight	Slight	Slight	Slight	Blackjack oak------- Black oak----------	50 ---	White oak, green ash.
65E2----------Lindley	5r	Moderate	Moderate	Moderate	Slight	Blackjack oak------- Black oak----------	50 ---	White oak, green ash.
65F----------Lindley	4r	Moderate	Moderate	Slight	Slight	White oak---------- Post oak---------- Blackjack oak------- Black oak---------- White oak---------- Post oak----------	60 --- --- --- --- ---	White oak, green ash.
65F2----------Lindley	5r	Moderate	Moderate	Moderate	Slight	Blackjack oak------- Black oak----------	50 ---	White oak, green ash.
76B, 76C2, 76D2----Ladoga	2o	Slight	Slight	Slight	Moderate	White oak---------- Northern red oak----	75 75	Eastern white pine, red pine, sugar maple, white oak, northern red oak.
80B, 80C, 80C2, 80D, 80D2, 80D3---Clinton	3o	Slight	Slight	Slight	Slight	White oak---------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut.
110B, 110C, 110E---Lamont	4o	Slight	Slight	Slight	Moderate	Northern red oak---- White oak----------	55 55	Eastern white pine, white oak, northern red oak.
140----------Sparta	3s	Slight	Slight	Severe	Slight	Northern red oak---- Red pine---------- Eastern white pine-- Jack pine----------	70 --- --- ---	Eastern white pine, red pine, jack pine.
141----------Watseka	---	---	---	---	---	---	---	Eastern white pine, red pine.
160----------Walford	2w	Slight	Severe	Moderate	Moderate	White oak---------- Northern red oak---- Bur oak----------	70 70 ---	White oak, northern red oak, green ash.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
161*: Walford	2w	Slight	Severe	Moderate	Moderate	White oak Northern red oak Bur oak	70 70 ---	White oak, northern red oak, green ash.
Atterberry	3o	Slight	Slight	Slight	Moderate	Northern red oak White oak Silver maple White ash Green ash	65 65 90 65 65	Eastern white pine, red pine, silver maple, green ash.
162B, 162C, 162C2, 162D2 Downs	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	Eastern white pine, northern red oak, green ash, yellow-poplar.
163B, 163C, 163C2, 163D, 163D2, 163D3 Fayette	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	Eastern white pine, northern red oak, green ash, yellow-poplar.
163E, 163E2, 163E3, 163F, 163F2, 163G Fayette	2r	Moderate	Moderate	Slight	Moderate	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	Eastern white pine, northern red oak, green ash, yellow-poplar.
165 Stronghurst	3o	Slight	Slight	Slight	Slight	White oak Northern red oak Green ash Bur oak	70 70 --- ---	Eastern white pine, red pine.
171B, 171C2, 171D2, 171D3 Bassett	4o	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, black walnut, sugar maple.
179D2 Gara	4o	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine.
179E2 Gara	4r	Moderate	Moderate	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine.
220 Nodaway	3o	Slight	Slight	Slight	Moderate	White oak	65	Eastern white pine, red pine, black walnut, sugar maple.
285C Burkhardt	4s	Slight	Slight	Moderate	Slight	Northern pin oak Black oak Jack pine	52 --- ---	Eastern white pine, red pine, jack pine.
291, 291B Atterberry	3o	Slight	Slight	Slight	Moderate	Northern red oak White oak Silver maple White ash Green ash	65 65 90 65 65	Eastern white pine, red pine, silver maple, green ash.
293C*, 293C2*, 293D*, 293D2*: Chelsea	3s	Slight	Slight	Moderate	Slight	White oak Red pine Eastern white pine Jack pine Quaking aspen Northern red oak	70 72 83 70 72 70	Eastern white pine, red pine, jack pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
293C*, 293C2*, 293D*, 293D2*: Lamont	4o	Slight	Slight	Slight	Moderate	Northern red oak White oak	55 55	Eastern white pine, white oak, northern red oak.
Fayette	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	Eastern white pine, northern red oak, green ash, yellow-poplar.
293E*, 293E2*, 293F*: Chelsea	3s	Moderate	Moderate	Moderate	Slight	White oak Red pine Eastern white pine Jack pine Quaking aspen Northern red oak	70 72 83 70 72 70	Eastern white pine, red pine, jack pine.
Lamont	4r	Moderate	Moderate	Slight	Moderate	Northern red oak White oak	55 55	Eastern white pine, white oak, northern red oak.
Fayette	2r	Moderate	Moderate	Slight	Moderate	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	Eastern white pine, northern red oak, green ash, yellow-poplar.
293G*: Chelsea.								
Lamont	4r	Moderate	Moderate	Slight	Moderate	Northern red oak White oak	55 55	Eastern white pine, white oak, northern red oak.
Fayette	2r	Moderate	Moderate	Slight	Moderate	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	Eastern white pine, northern red oak, green ash, yellow-poplar.
320 Arenzville	3o	Slight	Slight	Slight	Severe	Northern red oak Bur oak Silver maple	65 --- ---	Red pine, eastern white pine, northern red oak, black walnut
352B, 352C2 Whittier	3o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, sugar maple, poplar.
422 Amana	3o	Slight	Slight	Slight	Moderate	White oak Northern red oak	62 58	Eastern white pine, red pine, black walnut, sugar maple.
430 Ackmore	3o	Slight	Slight	Slight	Moderate	White oak	65	Eastern white pine, red pine, black walnut, sugar maple, poplar.
453 Tuskeego	3w	Slight	Severe	Moderate	Severe	Eastern cottonwood Silver maple	90 80	Eastern cottonwood, silver maple, American sycamore, green ash.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
520---------- Coppock	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, sugar maple.
						Northern red oak----	65	
539---------- Perks	4s	Slight	Slight	Moderate	Slight	White oak----------	55	Eastern white pine.
621---------- Houghton	4w	Slight	Severe	Severe	Severe	White ash----------	51	---
						Red maple----------	51	
						Quaking aspen-------	56	
						Black willow--------	---	
						Silver maple--------	76	
687, 687B---------- Watkins	3o	Slight	Slight	Slight	Slight	White oak----------	70	Eastern white pine, red pine, sugar maple.
688---------- Koszta	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, sugar maple.
						Northern red oak----	70	
727---------- Udolpho	3w	Slight	Moderate	Slight	Severe	Eastern cottonwood--	90	Eastern cottonwood.
						Green ash----------	50	
729B*:								
Nodaway----------	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, black walnut, sugar maple.
Arenzville--------	3o	Slight	Slight	Slight	Severe	Northern red oak----	65	Red pine, eastern white pine, northern red oak, black walnut.
						Bur oak----------	---	
						Silver maple--------	---	
761---------- Franklin	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, white oak, black walnut, sugar maple, northern red oak.
						Northern red oak----	65	
771B, 771C2-------- Waubeek	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	65	
778, 778B---------- Sattre	3o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine, black walnut, sugar maple.
						White oak----------	65	
792D2---------- Armstrong	4c	Slight	Slight	Severe	Slight	White oak----------	55	Eastern white pine, red pine, black walnut, sugar maple, poplar.
						Northern red oak----	55	
793---------- Bertrand	3o	Slight	Slight	Slight	Severe	Northern red oak----	>70	Red pine, eastern white pine, black walnut, northern red oak.
						White ash----------	---	
						White oak----------	---	
						Bur oak----------	---	

See footnote at end of table

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
876B---------- Ladoga	2o	Slight	Slight	Slight	Moderate	White oak----------	75	Eastern white pine, red pine, sugar maple.
						Northern red oak----	75	
993D2*:								
Gara----------	4o	Slight	Slight	Slight	Slight	White oak----------	55	Eastern white pine, red pine.
						Northern red oak----	55	
Armstrong---------	4c	Slight	Slight	Severe	Slight	White oak----------	55	Eastern white pine, red pine, black walnut, sugar maple, poplar.
						Northern red oak----	55	
993E2*:								
Gara----------	4r	Moderate	Moderate	Slight	Slight	White oak----------	55	Eastern white pine, red pine.
						Northern red oak----	55	
Armstrong---------	4c	Moderate	Moderate	Severe	Slight	White oak----------	55	Eastern white pine, red pine, black walnut, sugar maple, poplar.
						Northern red oak----	55	
1160---------- Walford	2w	Slight	Severe	Moderate	Moderate	White oak----------	70	Eastern white pine, red pine.
						Northern red oak----	70	
						Bur oak----------	---	
1220---------- Nodaway	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, black walnut, sugar maple.
1291---------- Atterberry	3o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine, silver maple, green ash.
						White oak----------	65	
						Silver maple---------	90	
						White ash----------	65	
						Green ash----------	65	
1315*:								
Perks----------	4s	Slight	Slight	Moderate	Slight	White oak----------	55	Eastern white pine.
Spillville.								
2422*:								
Amana----------	3o	Slight	Slight	Slight	Moderate	White oak----------	62	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	58	
Lawson.								
Perks----------	4s	Slight	Slight	Moderate	Slight	White oak----------	55	Eastern white pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
7---------- Wiota	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
11B*: Colo----------	Gray dogwood, silky dogwood.	Tatarian honeysuckle, redosier dogwood, Amur honeysuckle.	White spruce, Amur maple, northern white-cedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Ely----------	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern cottonwood, silver maple.
41, 41B, 41C, 41D- Sparta	---	Amur honeysuckle, lilac, eastern redcedar, autumn-olive, Tatarian honey-suckle.	Red pine, jack pine, Austrian pine, willow.	Eastern white pine.	---
43---------- Bremer	Silky dogwood, gray dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum, Amur honeysuckle.	Northern white-cedar, Amur maple.	Green ash, golden willow.	Eastern cottonwood, silver maple.
54---------- Zook	Silky dogwood, gray dogwood.	Redosier dogwood, Tatarian honey-suckle, American plum, Amur honeysuckle.	Northern white-cedar, Amur maple.	Green ash, golden willow.	Eastern cottonwood, silver maple.
63B, 63C---------- Chelsea	Lilac----------	Siberian peashrub, eastern redcedar, autumn-olive.	Red pine, Austrian pine, jack pine.	Eastern white pine.	---
63E. Chelsea					
65D2, 65E2, 65F, 65F2---------- Lindley	Silky dogwood, gray dogwood.	American plum, redosier dogwood.	Eastern redcedar, hackberry.	Austrian pine, Scotch pine, Norway spruce, red pine.	Eastern white pine, silver maple.
75---------- Givin	Redosier dogwood, gray dogwood, silky dogwood.	Tatarian honey-suckle, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
76B, 76C2, 76D2--- Ladoga	Gray dogwood, silky dogwood.	Redosier dogwood, lilac, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
80B, 80C, 80C2, 80D, 80D2, 80D3-- Clinton	Silky dogwood, gray dogwood.	Lilac, Tatarian honeysuckle, redosier dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
83B, 83C2--------- Kenyon	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
88---------- Nevin	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern cottonwood, silver maple.
110B, 110C, 110E-- Lamont	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple, blue spruce.	Eastern white pine, red pine, Norway spruce, hackberry.	---
118---------- Garwin	Silky dogwood, gray dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle, Amur honeysuckle.	Amur maple, northern white-cedar.	Green ash, golden willow.	Eastern cottonwood, silver maple.
119, 119B--------- Muscatine	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine. silver maple.
120B, 120C, 120C2, 120D2---------- Tama	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.
122---------- Sperry	Silky dogwood, gray dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle, Amur honeysuckle.	Amur maple, northern white-cedar.	Green ash, golden willow.	Eastern cottonwood, silver maple.
133, 133+--------- Colo	Gray dogwood, silky dogwood.	Tatarian honeysuckle, redosier dogwood, Amur honeysuckle.	Laurel willow, white spruce, Amur maple, northern white-cedar.	Green ash, golden willow.	Silver maple, eastern white pine.
135---------- Coland	Gray dogwood------	Redosier dogwood, Tatarian honeysuckle, silky dogwood, Amur honeysuckle.	White spruce, northern white-cedar, Amur maple.	Green ash, golden willow.	Eastern cottonwood, silver maple.
140---------- Sparta	Siberian peashrub	Amur honeysuckle, Tatarian honeysuckle, autumn-olive, eastern redcedar, lilac.	Austrian pine, jack pine, red pine.	Eastern white pine.	---
141---------- Watseka	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
152---------- Marshan	---	Redosier dogwood, northern white-cedar, American plum, purpleosier willow, Tatarian honeysuckle.	Amur maple, white spruce.	Golden willow, hackberry. green ash.	Silver maple, eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
160---------- Walford	Gray dogwood, silky dogwood.	Tatarian honeysuckle, redosier dogwood, Amur honeysuckle.	Amur maple, northern white-cedar, Norway spruce.	Green ash, golden willow.	Eastern cottonwood, silver maple.
161*: Walford----------	Gray dogwood, silky dogwood.	Tatarian honeysuckle, redosier dogwood, Amur honeysuckle.	Amur maple, northern white-cedar, Norway spruce, blue spruce.	Green ash---------	Eastern cottonwood, silver maple.
Atterberry-------	Silky dogwood-----	American cranberrybush, lilac, Amur honeysuckle.	White spruce, Austrian pine, northern white-cedar.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.
162B, 162C, 162C2, 162D2---------- Downs	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
163B, 163C, 163C2, 163D, 163D2, 163D3, 163E, 163E2, 163E3----- Fayette	Gray dogwood, common ninebark.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern white pine, silver maple.
163F, 163F2, 163G. Fayette					
165---------- Stronghurst	Gray dogwood, redosier dogwood.	Autumn-olive, silky dogwood, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Norway spruce, red pine, hackberry.	Eastern white pine, silver maple.
171B, 171C2, 171D2, 171D3----- Bassett	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
173---------- Hoopeston	---	Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, northern white-cedar, white spruce.	Green ash, red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
174B---------- Bolan	Siberian peashrub	Amur honeysuckle, autumn-olive, Tatarian honeysuckle, lilac, Washington hawthorn.	Honeylocust, green ash, eastern redcedar, eastern white pine, red pine, jack pine, Austrian pine.	---	---
175, 175B, 175C--- Dickinson	Siberian peashrub	Amur honeysuckle, autumn-olive, Tatarian honeysuckle, lilac, Washington hawthorn.	Honeylocust, eastern redcedar, green ash, eastern white pine, red pine, jack pine, Austrian pine.	---	---
178---------- Waukee	Siberian peashrub	Amur honeysuckle, autumn-olive, Tatarian honeysuckle, lilac, Washington hawthorn.	Honeylocust, red pine, jack pine, green ash, eastern white pine, Austrian pine.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
179D2, 179E2---- Gara	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
184---- Klinger	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Norway spruce, hackberry, red pine, eastern white pine.	Silver maple.
220---- Nodaway	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Norway spruce, hackberry, red pine, eastern white pine.	Silver maple.
226---- Lawler	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Silver maple, eastern cottonwood.
279---- Taintor	Silky dogwood, gray dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle, Amur honeysuckle.	Amur maple, northern white-cedar.	Green ash, golden willow.	Eastern white pine, silver maple.
280---- Mahaska	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
281B, 281C2, 281D2---- Otley	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
284---- Flagler	Silky dogwood----	Amur honeysuckle, Tatarian honeysuckle, American plum.	Eastern redcedar, Amur maple, Austrian pine, blue spruce, eastern white pine.	Red pine, Norway spruce, hackberry.	---
285C---- Burkhardt	---	Eastern redcedar, Russian-olive, Siberian crabapple, Tatarian honeysuckle, Amur honeysuckle, lilac.	Eastern white pine, green ash, honeylocust, jack pine, red pine, Austrian pine.	---	---
291, 291B---- Atterberry	Silky dogwood----	American cranberrybush, lilac, Amur honeysuckle.	White spruce, Austrian pine, northern white-cedar.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.
293C*, 293C2*, 293D*, 293D2*: Chelsea----	Lilac----	Siberian peashrub, eastern redcedar, autumn-olive.	Red pine, common hackberry, Austrian pine, jack pine.	Eastern white pine.	---
Lamont----	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple, blue spruce.	Eastern white pine, red pine, Norway spruce, hackberry.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
293C*, 293C2*, 293D*, 293D2*: Fayette	Gray dogwood, common ninebark.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern white pine, silver maple.
293E*, 293E2*: Chelsea.					
Lamont	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple, blue spruce.	Red pine, Norway spruce, hackberry, eastern white pine.	---
Fayette	Gray dogwood, common ninebark.	Redosier dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern white pine, silver maple.
293F*, 293G*: Chelsea.					
Lamont	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple, blue spruce.	Red pine, Norway spruce, hackberry, eastern white pine.	---
Fayette.					
320 Arenzville	---	Tatarian honeysuckle, lilac.	Northern white-cedar, Siberian crabapple, white spruce, Amur maple.	Green ash, hackberry, red pine, bur oak, eastern white pine.	Silver maple.
350B Waukegan	---	Siberian peashrub, Siberian crabapple, lilac, Tatarian honeysuckle, Amur honeysuckle, autumn-olive.	Honeylocust, eastern redcedar, red pine, jack pine, eastern white pine, green ash, Austrian pine.	---	---
352B, 352C2 Whittier	---	Siberian peashrub, Siberian crab-apple, lilac, Tatarian honey-suckle, Amur honeysuckle, autumn-olive.	Honeylocust, eastern redcedar, red pine, jack pine, eastern wite pine, green ash, Austrian pine.	---	---
377B, 377C2 Dinsdale	Gray dogwood, silky dogwood.	Redosier dogwood, Amur honeysuckle, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
382 Maxfield	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum, Amur honeysuckle.	Amur maple, northern white-cedar.	Green ash, golden willow.	Silver maple, eastern white pine.
420B Tama	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
422---------- Amana	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry, golden willow.	Silver maple, eastern cottonwood.
428B----------	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern cottonwood, silver maple.
430----------	Silky dogwood, gray dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Red pine, Norway spruce, hackberry.	Eastern cottonwood, silver maple.
442B*, 442C2*, 442D2*: Tama----------	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.
Dickinson-------	Siberian peashrub	Amur honeysuckle, Tatarian honeysuckle, lilac, autumn-olive, Washington hawthorn.	Honeylocust, green ash, eastern redcedar, red pine, jack pine, eastern white pine, Austrian pine.	---	---
453---------- Tuskeego	Silky dogwood, gray dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle, Amur honeysuckle.	Amur maple, northern white-cedar.	Green ash, golden willow.	Eastern cottonwood, silver maple.
484---------- Lawson	Silky dogwood, gray dogwood.	Amur honeysuckle, redosier dogwood, American plum.	Eastern redcedar, Russian-olive.	Red pine, Norway spruce, hackberry.	Eastern white pine, eastern cottonwood.
485---------- Spillville	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
520---------- Coppock	Silky dogwood, gray dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle, Amur honeysuckle.	Amur maple, northern white-cedar.	Green ash, golden willow.	Eastern cottonwood, silver maple.
539---------- Perks	Silky dogwood, gray dogwood.	Amur honeysuckle, Tatarian honeysuckle, eastern redcedar.	Eastern redcedar, Russian-olive.	Red pine, Norway spruce, hackberry.	Eastern cottonwood silver maple.
621---------- Houghton	Whitebelle honeysuckle.	Amur privet, silky dogwood, Tatarian honeysuckle, common ninebark.	Tall purple willow.	Golden willow, black willow, white willow.	Imperial Carolina poplar.
687, 687B---------- Watkins	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
688--- Koszta	Redosier dogwood, gray dogwood, silky dogwood.	Tatarian honeysuckle, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern cottonwood, silver maple.
727--- Udolpho	---	Tatarian honeysuckle, redosier dogwood, Amur honeysuckle.	Norway spruce, Amur maple, Siberian crabapple, northern white-cedar.	Silver maple, green ash, golden willow, eastern white pine.	Eastern cottonwood.
729B*: Nodaway---	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Norway spruce, hackberry, red pine, eastern white pine.	Silver maple.
Arenzville---	Silky dogwood, common ninebark.	Lilac, northern white-cedar.	White spruce, Norway spruce.	Red pine, eastern white pine.	---
760--- Ansgar	Silky dogwood, gray dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle, Amur honeysuckle.	Amur maple, northern white-cedar.	Green ash, golden willow.	Eastern white pine, silver maple.
761--- Franklin	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
771B, 771C2--- Waubeek	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
778, 778B--- Sattre	Siberian peashrub	Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle, lilac, autumn-olive.	Honeylocust, green ash, red pine, jack pine, eastern white pine, Austrian pine.	---	---
792D2--- Armstrong	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.
793--- Bertrand	---	Tatarian honeysuckle, lilac.	Northern white-cedar, Siberian crabapple, white spruce, Amur maple.	Green ash, bur oak, red pine, hackberry.	Silver maple, eastern white pine.
826--- Rowley	Silky dogwood, gray dogwood.	Tatarian honeysuckle, redosier dogwood, American plum.	Amur maple, eastern redcedar.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
876B--- Ladoga	Gray dogwood, silky dogwood.	Redosier dogwood, lilac, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
920, 920B--------- Tama	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
962--------------- Elvira	Silky dogwood, common ninebark.	Redosier dogwood, American plum, Amur honeysuckle, Tatarian honeysuckle.	Northern white-cedar, Amur maple.	Green ash, golden willow.	Silver maple, eastern cottonwood.
974B-------------- Bolan	Siberian peashrub	Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle, lilac, autumn-olive.	Honeylocust, green ash, eastern redcedar, eastern white pine, red pine, jack pine, Austrian pine.	---	---
976--------------- Raddle	Redosier dogwood, gray dogwood.	Silky dogwood, Tatarian honeysuckle, American plum.	Amur maple, eastern redcedar.	Red pine, Norway spruce, hackberry.	Eastern cottonwood, silver maple.
993D2*, 993E2*: Gara--------------	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
Armstrong--------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, American plum.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.
1119-------------- Muscatine	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
1160-------------- Walford	Gray dogwood, silky dogwood.	Tatarian honeysuckle, redosier dogwood, Amur honeysuckle.	Amur maple, northern white-cedar, Norway spruce.	Green ash, golden willow.	Eastern cottonwood, silver maple.
1220. Nodaway					
1280-------------- Mahaska	Gray dogwood, silky dogwood.	Redosier dogwood, American plum, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry.	Eastern white pine, silver maple.
1291-------------- Atterberry	Silky dogwood-----	American cranberrybush, lilac, Amur honeysuckle.	White spruce, Austrian pine, northern white-cedar.	Red pine, Norway spruce, hackberry.	Silver maple, eastern white pine.
1315*: Perks----------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
Spillville-------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
1316*. Fluvaquents					
1484---------- Lawson	Silky dogwood, gray dogwood.	Amur honeysuckle redosier dogwood, American plum.	Eastern redcedar, Russian-olive.	Red pine, Norway spruce, hackberry.	Eastern white pine, eastern cottonwood.
1485---------- Spillville	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
2422*:					
Amana----------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, hackberry, golden willow.	Silver maple, eastern cottonwood.
Lawson----------	Silky dogwood, gray dogwood.	Amur honeysuckle, redosier dogwood, American plum.	Eastern redcedar, Russian-olive.	Red pine, Norway spruce, hackberry.	Eastern white cedar, eastern cottonwood.
Perks----------	Gray dogwood, silky dogwood.	Redosier dogwood, Tatarian honeysuckle, lilac.	Amur maple, eastern redcedar.	Hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
7--- Wiota	Severe: floods.	Slight---	Slight---	Slight---	Slight.
11B*:					
Colo---	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
Ely---	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight---	Slight.
41--- Sparta	Slight---	Slight---	Moderate: small stones.	Slight---	Moderate: droughty.
41B--- Sparta	Slight---	Slight---	Moderate: slope, small stones.	Slight---	Moderate: droughty.
41C--- Sparta	Slight---	Slight---	Severe: slope.	Slight---	Moderate: droughty.
41D--- Sparta	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: droughty, slope.
43--- Bremer	Severe: wetness, floods.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
54--- Zook	Severe: wetness, floods.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
63B--- Chelsea	Slight---	Slight---	Moderate: slope.	Slight---	Moderate: droughty.
63C--- Chelsea	Slight---	Slight---	Severe: slope.	Slight---	Moderate: droughty.
63E--- Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65D2--- Lindley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight---	Moderate: slope.
65E2, 65F, 65F2--- Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
75--- Givin	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight---	Slight.
76B--- Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight---	Slight.
76C2--- Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight---	Slight.
76D2--- Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight---	Moderate: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
80B---------- Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
80C, 80C2---------- Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
80D, 80D2, 80D3------- Clinton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
83B---------- Kenyon	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
83C2---------- Kenyon	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
88---------- Nevin	Severe: floods.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
110B---------- Lamont	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
110C---------- Lamont	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
110E---------- Lamont	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
118---------- Garwin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
119---------- Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
119B---------- Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
120B---------- Tama	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
120C, 120C2---------- Tama	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
120D2---------- Tama	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
122---------- Sperry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
133---------- Colo	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
133+---------- Colo	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: floods, wetness.	Severe: floods.
135---------- Coland	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
140---------- Sparta	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: droughty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
141--- Watseka	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
152--- Marshan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
160--- Walford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
161*:					
Walford---	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Atterberry---	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
162B--- Downs	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
162C, 162C2--- Downs	Slight---	Slight---	Severe: slope.	Slight---	Slight.
162D2--- Downs	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: slope.
163B--- Fayette	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
163C, 163C2--- Fayette	Slight---	Slight---	Severe: slope.	Slight---	Slight.
163D, 163D2, 163D3--- Fayette	Moderate: slope.	Moderate: slope.	Severe: slope	Slight---	Moderate: slope.
163E, 163E2, 163E3, 163F, 163F2--- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
163G--- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
165--- Stronghurst	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
171B--- Bassett	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
171C2--- Bassett	Slight---	Slight---	Severe: slope.	Slight---	Slight.
171D2, 171D3--- Bassett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: slope.
173--- Hoopeston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
174B--- Bolan	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
175--- Dickinson	Slight---	Slight---	Slight---	Slight---	Slight.
175B--- Dickinson	Slight---	Slight---	Moderate: slope.	Slight---	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
175C---------- Dickinson	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
178---------- Waukee	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
179D2---------- Gara	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
179E2---------- Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
184---------- Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Moderate: wetness.
220---------- Nodaway	Severe: floods.	Slight----------	Moderate: floods.	Slight----------	Moderate: floods.
226---------- Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
279---------- Taintor	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
280---------- Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
281B---------- Otley	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
281C2---------- Otley	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
281D2---------- Otley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
284---------- Flagler	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
285C---------- Burkhardt	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: droughty.
291, 291B---------- Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
293C*, 293C2*:					
Chelsea----------	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: droughty.
Lamont----------	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
Fayette----------	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
293D*, 293D2*:					
Chelsea----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope, droughty.
Lamont----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
Fayette----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
293E*, 293E2*, 293F*:					
Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Lamont	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
293G*:					
Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lamont	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
320 Arenzville	Severe: floods.	Moderate: floods.	Severe: floods.	Severe: erodes easily.	Severe: floods.
350B Waukegan	Slight	Slight	Moderate: slope.	Slight	Slight.
352B, 352C2 Whittier	Slight	Slight	Moderate: slope.	Slight	Slight.
377B Dinsdale	Slight	Slight	Moderate: slope.	Slight	Slight.
377C2 Dinsdale	Slight	Slight	Severe: slope.	Slight	Slight.
382 Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
420B Tama	Slight	Slight	Moderate: slope.	Slight	Slight.
422 Amana	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
428B Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
430 Ackmore	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
442B*, 442C2*:					
Tama	Slight	Slight	Severe: slope.	Slight	Slight.
Dickinson	Slight	Slight	Severe: slope.	Slight	Slight.
442D2*:					
Tama	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Dickinson	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
453--Tuskeego	Severe: floods, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
484--Lawson	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
485--Spillville	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
520--Coppock	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
539--Perks	Severe: floods.	Slight	Moderate: floods.	Slight	Severe: droughty.
621--Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
687--Watkins	Slight	Slight	Slight	Slight	Slight.
687B--Watkins	Slight	Slight	Moderate: slope.	Slight	Slight.
688--Koszta	Severe: floods.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
727--Udolpho	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
729B*:					
Nodaway	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
Arenzville	Severe: floods.	Moderate: floods.	Severe: floods.	Severe: erodes easily.	Severe: floods.
760--Ansgar	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
761--Franklin	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
771B--Waubeek	Slight	Slight	Moderate: slope.	Slight	Slight.
771C2--Waubeek	Slight	Slight	Severe: slope.	Slight	Slight.
778--Sattre	Slight	Slight	Slight	Slight	Slight.
778B--Sattre	Slight	Slight	Moderate: slope.	Slight	Slight.
792D2--Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
793--Bertrand	Slight	Slight	Slight	Severe: erodes easily.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
826---------- Rowley	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
876B---------- Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
920---------- Tama	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
920B---------- Tama	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
962---------- Elvira	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: floods.
974B---------- Bolan	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
976---------- Raddle	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
993D2*: Gara----------	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
Armstrong----------	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
993E2*: Gara----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Armstrong----------	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Moderate: slope, wetness.	Severe: slope.
1119---------- Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
1160---------- Walford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1220---------- Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
1280---------- Mahaska	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
1291---------- Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
1315*: Perks----------	Severe: floods.	Slight----------	Moderate: floods.	Slight----------	Severe: droughty.
Spillville----------	Severe: floods.	Slight----------	Moderate: floods.	Slight----------	Moderate: floods.
1316*. Fluvaquents					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1484---------- Lawson	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
1485---------- Spillville	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
2422*: Amana----------	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
Lawson----------	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods.
Perks----------	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods, droughty.
5040*. Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
7---------- Wiota	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
11B*: Colo----------	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Poor.
Ely----------	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
41, 41B---------- Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
41C, 41D---------- Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
43---------- Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
54---------- Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
63B, 63C---------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
63E---------- Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
65D2---------- Lindley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65E2, 65F, 65F2---- Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
75---------- Givin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
76B---------- Ladoga	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
76C2, 76D2--------- Ladoga	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
80B---------- Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
80C, 80C2, 80D, 80D2, 80D3--------- Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
83B---------- Kenyon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
83C2---------- Kenyon	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
88---------- Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
110B---------- Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
110C, 110E--------- Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
118---------- Garwin	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
119, 119B---------- Muscatine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
120B---------- Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
120C, 120C2, 120D2- Tama	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
122---------- Sperry	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
133, 133+---------- Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
135---------- Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
140---------- Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
141---------- Watseka	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
152---------- Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
160---------- Walford	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
161*: Walford---------- Atterberry--------	Fair Fair	Fair Good	Fair Good	Poor Good	Poor Good	Good Fair	Good Fair	Fair Good	Poor Good	Good. Fair.
162B---------- Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
162C, 162C2, 162D2- Downs	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163B---------- Fayette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163C, 163C2, 163D, 163D2, 163D3------ Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163E, 163E2, 163E3, 163F, 163F2------- Fayette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
163G---------- Fayette	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
165---------- Stronghurst	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
171B---------- Bassett	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
171C2, 171D2, 171D3--Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
173--Hoopeston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
174B--Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
175, 175B--Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
175C--Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
178--Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
179D2--Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
179E2--Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
184--Klinger	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
220--Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
226--Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
279--Taintor	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
280--Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
281B--Otley	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
281C2, 281D2--Otley	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Very poor.
284--Flagler	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
285C--Burkhardt	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
291--Atterberry	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
291B--Atterberry	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
293C*, 293C2*: Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
293C*, 293C2*: Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
293D*, 293D2*: Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
293E*, 293E2*, 293F*: Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Lamont	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Fayette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
293G*: Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Lamont	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Fayette	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
320--- Arenzville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
350B--- Waukegan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
352B, 352C2--- Whittier	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
377B--- Dinsdale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
377C2--- Dinsdale	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
382--- Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
420B--- Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
422--- Amana	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
428B--- Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
430--- Ackmore	Very poor.	Poor	Good	Good	Good	Fair	Fair	Poor	Good	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
442B*, 442C2*, 442D2*:										
Tama	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
453 Tuskeego	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
484 Lawson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
485 Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
520 Coppock	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
539 Perks	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
621 Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
687, 687B Watkins	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
688 Koszta	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
727 Udolpho	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
729B*:										
Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
Arenzville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
760 Ansgar	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
761 Franklin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
771B Waubeek	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
771C2 Waubeek	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
778, 778B Sattre	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
792D2 Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
793 Bertrand	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
826 Rowley	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
876B Ladoga	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
920, 920B---------- Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
962---------- Elvira	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
974B---------- Bolan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
976---------- Raddle	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
993D2*:										
Gara----------	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
Armstrong---------	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
993E2*:										
Gara----------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Armstrong---------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
1119---------- Muscatine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1160---------- Walford	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
1220---------- Nodaway	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
1280---------- Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1291---------- Atterberry	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1315*:										
Perks----------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Spillville--------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1316*. Fluvaquents										
1484---------- Lawson	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
1485---------- Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
2422*:										
Amana----------	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
Lawson----------	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
Perks----------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
5040*. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
7--- Wiota	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action.	Slight.
11B*:						
Colo	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.
Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
41, 41B--- Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
41C--- Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
41D--- Sparta	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
43--- Bremer	Severe: wetness.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: low strength, frost action.	Moderate: wetness.
54--- Zook	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.
63B--- Chelsea	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
63C--- Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63E--- Chelsea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65D2--- Lindley	Moderate: dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
65E2, 65F, 65F2--- Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
75--- Givin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
76B--- Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
76C2--- Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
76D2--- Ladoga	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
80B---------- Clinton	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
80C, 80C2--------- Clinton	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
80D, 80D2, 80D3--- Clinton	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
83B---------- Kenyon	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
83C2---------- Kenyon	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
88---------- Nevin	Severe: wetness.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Severe: frost action, low strength.	Slight.
110B---------- Lamont	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
110C---------- Lamont	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
110E---------- Lamont	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
118---------- Garwin	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength.	Moderate: wetness.
119, 119B--------- Muscatine	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
120B---------- Tama	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
120C, 120C2------- Tama	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
120D2---------- Tama	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
122---------- Sperry	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
133---------- Colo	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.
133+---------- Colo	Severe: wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, frost action.	Severe: floods.
135---------- Coland	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.

See footnote at end of table.

TABLE 11--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
140---------- Sparta	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
141---------- Watseka	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
152---------- Marshan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
160---------- Walford	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, frost action, low strength.	Severe: wetness.
161*: Walford----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, frost action, low strength.	Severe: wetness.
Atterberry-------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
162B---------- Downs	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
162C, 162C2------- Downs	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
162D2---------- Downs	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
163B---------- Fayette	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
163C, 163C2------- Fayette	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
163D, 163D2, 163D3---------- Fayette	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
163E, 163E2, 163E3, 163F, 163F2, 163G------ Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
165---------- Stronghurst	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
171B---------- Bassett	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
171C2---------- Bassett	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
171D2, 171D3---- Bassett	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
173---- Hoopeston	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
174B---- Bolan	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Moderate: frost action.	Slight.
175, 175B---- Dickinson	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Moderate: frost action.	Slight.
175C---- Dickinson	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Moderate: frost action.	Slight.
178---- Waukee	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Moderate: low strength.	Slight.
179D2---- Gara	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
179E2---- Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
184---- Klinger	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Moderate: wetness.
220---- Nodaway	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.	Moderate: floods.
226---- Lawler	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
279---- Taintor	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
280---- Mahaska	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: low strength, frost action.	Slight.
281B---- Otley	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
281C2---- Otley	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
281D2---- Otley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
284---- Flagler	Severe: cutbanks cave.	---	---	---	---	Slight.
285C---- Burkhardt	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Slight----	Moderate: droughty.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
291, 291B--------- Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
293C*, 293C2*: Chelsea----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
Lamont----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
Fayette----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
293D*, 293D2*: Chelsea----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
Lamont----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Fayette----------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
293E*, 293E2*, 293F*, 293G*: Chelsea---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lamont----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fayette---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
320----------	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
350B----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
352B, 352C2------- Whittier	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength.	Slight.
377B---------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
377C2---------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
382---------- Maxfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
420B---------- Tama	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
422---------- Amana	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength, frost action.	Moderate: floods.
428B---------- Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
430---------- Ackmore	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness.	Severe: low strength, floods, frost action.	Severe: floods.
442B*, 442C2*: Tama----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
Dickinson--------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
442D2*: Tama----------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
Dickinson--------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
453---------- Tuskeego	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
484---------- Lawson	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Moderate: wetness, floods.
485---------- Spillville	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
520---------- Coppock	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength, frost action.	Moderate: wetness, floods.
539---------- Perks	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: droughty.
621---------- Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
687, 687B--------- Watkins	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
688---------- Koszta	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: low strength, frost action.	Slight.
727---------- Udolpho	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
729B*: Nodaway	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.	Moderate: floods.
Arenzville	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
760 Ansgar	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, frost action, low strength.	Moderate: wetness.
761 Franklin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
771B Waubeek	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
771C2 Waubeek	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
778, 778B Sattre	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
792D2 Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.
793 Bertrand	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
826 Rowley	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, floods, frost action.	Moderate: wetness, floods.
876B Ladoga	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
920, 920B Tama	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
962 Elvira	Severe: wetness, cutbanks cave.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, frost action.	Severe: floods.
974B Bolan	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
976 Raddle	Slight	Slight	Slight	Slight	Severe: frost action.	Slight.
993D2*: Gara	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
993D2*:						
Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action.	Moderate: slope, wetness.
993E2*:						
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Armstrong	Severe: wetness, slope.	Severe: shrink-swell, wetness, slope.	Severe: slope, wetness.	Severe: shrink-swell, wetness, slope.	Severe: low strength, frost action, slope.	Severe: slope.
1119 Muscatine	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
1160 Walford	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, frost action, low strength.	Severe: wetness.
1220 Nodaway	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.	Severe: floods.
1280 Mahaska	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: low strength, frost action.	Slight.
1291 Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
1315*:						
Perks	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: droughty.
Spillville	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
1316*. Fluvaquents						
1484 Lawson	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
1485 Spillville	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Severe: floods.
2422*:						
Amana	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength, frost action.	Severe: floods.
Lawson	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
Perks	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, droughty.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
5040*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
7--- Wiota	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
11B*:					
Colo---	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, hard to pack.
Ely---	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
41, 41B--- Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
41C, 41D--- Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
43--- Bremer	Severe: percs slowly, wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Poor: wetness.
54--- Zook	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: too clayey, wetness, hard to pack.
63B--- Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
63C--- Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
63E--- Chelsea	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
65D2--- Lindley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
65E2, 65F, 65F2--- Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
75--- Givin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
76B--- Ladoga	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
76C2--- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight---	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
76D2--- Ladoga	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
80B--- Clinton	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
80C, 80C2--- Clinton	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
80D, 80D2, 80D3--- Clinton	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
83B--- Kenyon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight---	Slight---	Good.
83C2--- Kenyon	Moderate: percs slowly.	Severe: slope.	Slight---	Slight---	Good.
88--- Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
110B--- Lamont	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
110C--- Lamont	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
110E--- Lamont	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
118--- Garwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
119, 119B--- Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
120B--- Tama	Slight---	Moderate: slope, seepage.	Moderate: too clayey.	Slight---	Fair: too clayey.
120C, 120C2--- Tama	Slight---	Severe: slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
120D2--- Tama	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
122--- Sperry	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
133, 133+--- Colo	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, hard to pack.
135--- Coland	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
140--Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
141--Watseka	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, seepage, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
152--Marshan	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
160--Walford	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
161*: Walford	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
162B--Downs	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
162C, 162C2--Downs	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
162D2--Downs	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
163B--Fayette	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
163C, 163C2--Fayette	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
163D, 163D2, 163D3--Fayette	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
163E, 163E2, 163E3, 163F, 163F2, 163G--Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
165--Stronghurst	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
171B--Bassett	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
171C2--Bassett	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
171D2, 171D3--Bassett	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
173---------- Hoopeston	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
174B---------- Bolan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175, 175B---------- Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175C---------- Dickinson	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
178---------- Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
179D2---------- Gara	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
179E2---------- Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
184---------- Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
220---------- Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
226---------- Lawler	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
279---------- Taintor	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
280---------- Mahaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
281B---------- Otley	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
281C2---------- Otley	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
281D2---------- Otley	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
284---------- Flagler	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
285C---------- Burkhardt	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
291, 291B---------- Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
293C*, 293C2*: Chelsea----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Lamont----------	Slight----------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
Fayette----------	Slight----------	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
293D*, 293D2*: Chelsea----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Lamont----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Fayette----------	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
293E*, 293E2*, 293F*, 293G*: Chelsea----------	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
Lamont----------	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Fayette----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
320---------- Arenzville	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, too sandy.	Severe: floods, wetness.	Poor: too sandy.
350B---------- Waukegan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
352B, 352C2---------- Whittier	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
377B---------- Dinsdale	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
377C2---------- Dinsdale	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
382---------- Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
420B---------- Tama	Slight----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
422---------- Amana	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
428B---------- Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
430---------- Ackmore	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness, hard to pack.
442B*, 442C2*: Tama----------	Slight----------	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Dickinson----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
442D2*: Tama----------	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Dickinson----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
453---------- Tuskeego	Severe: wetness, percs slowly.	Severe: floods, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
484---------- Lawson	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
485---------- Spillville	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods.	Fair: wetness.
520---------- Coppock	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
539---------- Perks	Severe: floods, poor filter.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: too sandy, seepage.
621---------- Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
687---------- Watkins	Slight----------	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
687B---------- Watkins	Slight----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
688---------- Koszta	Severe: wetness.	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Fair: too clayey, wetness.
727---------- Udolpho	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
729B*:					
Nodaway----------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
Arenzville---------	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, too sandy.	Severe: floods, wetness.	Poor: too sandy.
760---------- Ansgar	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
761---------- Franklin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
771B---------- Waubeek	Slight----------	Severe: seepage.	Slight----------	Slight----------	Good.
771C2---------- Waubeek	Slight----------	Severe: seepage, slope.	Slight----------	Slight----------	Good.
778, 778B---------- Sattre	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
792D2---------- Armstrong	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
793---------- Bertrand	Slight----------	Severe: seepage.	Severe: seepage.	Slight----------	Fair: too clayey, thin layer.
826---------- Rowley	Severe: floods, wetness.	Severe: seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, wetness.	Poor: wetness.
876B---------- Ladoga	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
920, 920B---------- Tama	Slight----------	Severe: seepage.	Severe: seepage.	Slight----------	Good.
962---------- Elvira	Severe: floods, wetness, poor filter.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness.
974B---------- Bolan	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
976---------- Raddle	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Good.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
993D2*:					
Gara	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
Armstrong	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
993E2*:					
Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Armstrong	Severe: percs slowly, slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness, slope.	Poor: slope, wetness.
1119 Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
1160 Walford	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
1220 Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
1280 Mahaska	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
1291 Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
1315*:					
Perks	Severe: floods, poor filter.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: too sandy, seepage.
Spillville	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods.	Fair: wetness.
1316*. Fluvaquents					
1484 Lawson	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
1485 Spillville	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods.	Fair: wetness.
2422*:					
Amana	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2422*:					
Lawson	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Perks	Severe: floods, poor filter.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: too sandy, seepage.
5040*.					
Orthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
7 Wiota	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
11B*: Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
41, 41B, 41C Sparta	Good	Probable	Improbable: too sandy.	Fair: too sandy.
41D Sparta	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
43 Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
54 Zook	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
63B, 63C Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
63E Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
65D2 Lindley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
65E2, 65F, 65F2 Lindley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
75 Givin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
76B, 76C2, 76D2 Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
80B, 80C, 80C2, 80D, 80D2, 80D3 Clinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
83B, 83C2 Kenyon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
88 Nevin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
110B, 110C Lamont	Good	Probable	Improbable: too sandy.	Good.
110E Lamont	Good	Probable	Improbable: too sandy.	Fair: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
118--- Garwin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
119, 119B--- Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
120B, 120C, 120C2--- Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
120D2--- Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
122--- Sperry	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
133, 133+--- Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
135--- Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
140--- Sparta	Good---	Probable---	Improbable: too sandy.	Fair: too sandy.
141--- Watseka	Fair: wetness.	Probable---	Improbable: too sandy.	Fair: too sandy.
152--- Marshan	Fair: wetness.	Probable---	Probable---	Fair: area reclaim, thin layer.
160--- Walford	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
161*: Walford---	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Atterberry---	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
162B, 162C, 162C2--- Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
162D2--- Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
163B, 163C, 163C2--- Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
163D, 163D2--- Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, thin layer.
163D3--- Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
163E, 163E2, 163E3, 163F, 163F2--- Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
163G---------- Fayette	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
165---------- Stronghurst	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
171B, 171C2---------- Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
171D2, 171D3---------- Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
173---------- Hoopeston	Fair: wetness.	Probable----------	Improbable: too sandy.	Fair: small stones, thin layer.
174B---------- Bolan	Good----------	Probable----------	Improbable: too sandy.	Good.
175, 175B, 175C------- Dickinson	Good----------	Probable----------	Improbable: too sandy.	Good.
178---------- Waukee	Good----------	Probable----------	Improbable: too sandy.	Good.
179D2---------- Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
179E2---------- Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
184---------- Klinger	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
220---------- Nodaway	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
226---------- Lawler	Fair: wetness.	Probable----------	Probable----------	Poor: area reclaim.
279---------- Taintor	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
280---------- Mahaska	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
281B, 281C2, 281D2---- Otley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
284---------- Flagler	Good----------	Probable----------	Probable----------	Fair: small stones, area reclaim, thin layer.
285C---------- Burkhardt	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
291, 291B---------- Atterberry	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
293C*, 293C2*: Chelsea----------	Good----------	Probable----------	Improbable: too sandy.	Fair: too sandy.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
293C*, 293C2*: Lamont	Good	Probable	Improbable: too sandy.	Good.
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
293D*, 293D2*: Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
Lamont	Good	Probable	Improbable: too sandy.	Fair: slope.
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, thin layer.
293E*, 293E2*, 293F*: Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Lamont	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
293G*: Chelsea	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
Lamont	---	Probable	Improbable: too sandy.	Poor: slope.
Fayette	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
320 Arenzville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
350B Waukegan	Good	Probable	Improbable: too sandy.	Fair: area reclaim, thin layer.
352B, 352C2 Whittier	Good	Probable	Improbable: too sandy.	Fair: thin layer.
377B, 377C2 Dinsdale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
382 Maxfield	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
420B Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
422 Amana	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
428B Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
430--- Ackmore	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
442B*, 442C2*: Tama---	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Dickinson---	Good---	Probable---	Improbable: too sandy.	Good.
442D2*: Tama---	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Dickinson---	Good---	Probable---	Improbable: too sandy.	Fair: slope.
453--- Tuskeego	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
484--- Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
485--- Spillville	Good---	Improbable: excess fines.	Improbable: excess fines.	Good.
520--- Coppock	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
539--- Perks	Good---	Probable---	Improbable: too sandy.	Fair: too sandy.
621--- Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
687, 687B--- Watkins	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
688--- Koszta	Fair: wetness.	Probable---	Improbable: excess fines.	Fair: thin layer.
727--- Udolpho	Fair: wetness.	Probable---	Improbable: too sandy.	Fair: area reclaim, thin layer.
729B*: Nodaway---	Good---	Improbable: excess fines.	Improbable: excess fines.	Good.
Arenzville---	Good---	Improbable: excess fines.	Improbable: excess fines.	Good.
760--- Ansgar	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
761--- Franklin	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
771B, 771C2--- Waubeek	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
778, 778B---------- Sattre	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
792D2---------- Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
793---------- Bertrand	Good----------	Probable----------	Improbable: too sandy.	Good.
826---------- Rowley	Fair: wetness.	Probable----------	Improbable: too sandy.	Good.
876B---------- Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
920, 920B---------- Tama	Good----------	Probable----------	Improbable: too sandy.	Good.
962---------- Elvira	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
974B---------- Bolan	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
976---------- Raddle	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
993D2*:				
Gara----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Armstrong----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
993E2*:				
Gara----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Armstrong----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
1119---------- Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1160---------- Walford	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1220---------- Nodaway	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
1280---------- Mahaska	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1291---------- Atterberry	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1315*:				
Perks----------	Good----------	Probable----------	Improbable: too sandy.	Fair: too sandy.
Spillville----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1316*. Fluvaquents				
1484---------- Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1485---------- Spillville	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
2422*:				
Amana----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lawson----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Perks----------	Good----------	Probable----------	Improbable: too sandy.	Fair: too sandy.
5040*. Orthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
7---------- Wiota	Moderate: seepage.	Slight----------	Deep to water	Favorable------	Erodes easily	Erodes easily.
11B*: Colo----------	Moderate: seepage, slope.	Severe: wetness.	Floods, frost action, slope.	Wetness, slope, floods.	Wetness--------	Wetness.
Ely----------	Moderate: slope, seepage.	Moderate: wetness.	Slope, frost action.	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
41, 41B, 41C------ Sparta	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
41D---------- Sparta	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
43---------- Bremer	Slight---------	Severe: wetness, hard to pack.	Frost action---	Wetness--------	Wetness--------	Wetness.
54---------- Zook	Slight---------	Severe: hard to pack, wetness.	Floods, percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
63B, 63C---------- Chelsea	Severe: seepage.	Severe: piping, seepage.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
63E---------- Chelsea	Severe: slope, seepage.	Severe: piping, seepage.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
65D2, 65E2, 65F, 65F2---------- Lindley	Severe: slope.	Slight---------	Deep to water	Rooting depth, slope.	Slope----------	Slope, rooting depth.
75---------- Givin	Slight---------	Moderate: wetness, hard to pack.	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
76B, 76C2--------- Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope----------	Erodes easily	Erodes easily.
76D2---------- Ladoga	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
80B, 80C, 80C2---- Clinton	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
80D, 80D2, 80D3--- Clinton	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
83B, 83C2--------- Kenyon	Moderate: slope, seepage.	Slight---------	Deep to water	Slope----------	Favorable------	Favorable.
88---------- Nevin	Moderate: seepage.	Moderate: wetness.	Frost action---	Wetness--------	Erodes easily, wetness.	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
110B, 110C---- Lamont	Severe: seepage.	Moderate: thin layer.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
110E---- Lamont	Severe: slope, seepage.	Moderate: thin layer.	Deep to water	Slope, soil blowing.	Soil blowing, slope.	Slope.
118---- Garwin	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness----	Wetness----	Wetness.
119---- Muscatine	Moderate: seepage.	Moderate: wetness.	Frost action---	Wetness----	Wetness, erodes easily.	Erodes easily.
119B---- Muscatine	Moderate: seepage, slope.	Moderate: wetness.	Slope, frost action.	Wetness, slope.	Wetness, erodes easily.	Erodes easily.
120B, 120C, 120C2- Tama	Moderate: slope, seepage.	Slight----	Deep to water	Slope----	Erodes easily	Erodes easily.
120D2---- Tama	Severe: slope.	Slight----	Deep to water	Slope----	Erodes easily, slope.	Slope, erodes easily.
122---- Sperry	Slight----	Severe: ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
133, 133+---- Colo	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Floods, wetness.	Wetness----	Wetness.
135---- Coland	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Wetness----	Wetness.
140---- Sparta	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
141---- Watseka	Severe: seepage.	Severe: piping, seepage, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
152---- Marshan	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness----	Wetness, too sandy.	Wetness.
160---- Walford	Slight----	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.	Wetness, percs slowly, erodes easily.
161*: Walford----	Slight----	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.	Wetness, percs slowly, erodes easily.
Atterberry----	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness----	Erodes easily, wetness.	Wetness, erodes easily.
162B, 162C, 162C2- Downs	Moderate: slope, seepage.	Slight----	Deep to water	Slope----	Erodes easily	Erodes easily.
162D2---- Downs	Severe: slope.	Slight----	Deep to water	Slope----	Slope, erodes easily.	Slope, erodes easily.
163B, 163C, 163C2- Fayette	Moderate: slope, seepage.	Slight----	Deep to water	Slope, erodes easily.	Favorable----	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
163D, 163D2, 163D3, 163E, 163E2, 163E3, 163F, 163F2, 163G---------- Fayette	Severe: slope.	Slight---------	Deep to water	Slope, erodes easily.	Slope----------	Slope, erodes easily.
165---------- Stronghurst	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
171B, 171C2------- Bassett	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
171D2, 171D3------ Bassett	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope----------	Slope.
173---------- Hoopeston	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Wetness.
174B---------- Bolan	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope----------	Too sandy------	Favorable.
175---------- Dickinson	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing---	Soil blowing, too sandy.	Favorable.
175B, 175C-------- Dickinson	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Soil blowing, too sandy.	Favorable.
178---------- Waukee	Severe: seepage.	Severe: seepage.	Deep to water	Favorable------	Too sandy------	Favorable.
179D2, 179E2------ Gara	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope----------	Slope.
184---------- Klinger	Moderate: seepage.	Moderate: wetness.	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
220---------- Nodaway	Moderate: seepage.	Severe: piping.	Deep to water	Floods, erodes easily.	Erodes easily	Erodes easily.
226---------- Lawler	Severe: seepage.	Severe: seepage.	Frost action, cutbanks cave.	Wetness--------	Wetness, too sandy.	Favorable.
279---------- Taintor	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Erodes easily, wetness.	Wetness, erodes easily.
280---------- Mahaska	Moderate: seepage.	Moderate: wetness, hard to pack.	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
281B, 281C2------- Otley	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope----------	Erodes easily	Erodes easily.
281D2---------- Otley	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
284---------- Flagler	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing---	Too sandy, soil blowing.	Favorable.
285C---------- Burkhardt	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
291---------- Atterberry	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Erodes easily, wetness.	Wetness, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
291B---------- Atterberry	Moderate: seepage, slope.	Severe: wetness.	Frost action, slope.	Wetness, slope.	Erodes easily, wetness.	Wetness, erodes easily.
293C*, 293C2*: Chelsea----------	Severe: seepage.	Severe: piping, seepage.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Lamont----------	Severe: seepage.	Moderate: thin layer.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
Fayette----------	Moderate: slope, seepage.	Slight---------	Deep to water	Slope, erodes easily.	Favorable------	Erodes easily.
293D*, 293D2*, 293E*, 293E2*, 293F*, 293G*: Chelsea----------	Severe: slope, seepage.	Severe: piping, seepage.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Lamont----------	Severe: slope, seepage.	Moderate: thin layer.	Deep to water	Slope, soil blowing.	Soil blowing, slope.	Slope.
Fayette----------	Severe: slope.	Slight---------	Deep to water	Slope, erodes easily.	Slope----------	Slope, erodes easily.
320---------- Arenzville	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, floods.	Erodes easily, too sandy.	Erodes easily.
350B---------- Waukegan	Severe: seepage.	Severe: seepage.	Deep to water	Slope----------	Erodes easily, too sandy.	Erodes easily.
352B, 352C2------- Whittier	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope----------	Erodes easily, too sandy.	Erodes easily.
377B, 377C2------- Dinsdale	Moderate: slope, seepage.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
382---------- Maxfield	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness, rooting depth.	Wetness--------	Wetness, rooting depth.
420B---------- Tama	Moderate: slope, seepage.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
422---------- Amana	Moderate: seepage.	Moderate: wetness.	Deep to water	Floods, erodes easily.	Erodes easily	Erodes easily.
428B---------- Ely	Moderate: slope, seepage.	Moderate: wetness.	Slope, frost action.	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
430---------- Ackmore	Moderate: seepage.	Severe: hard to pack, wetness.	Floods, frost action.	Wetness, erodes easily.	Wetness, erodes easily.	Wetness, erodes easily.
442B*, 442C2*: Tama----------	Moderate: slope, seepage.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
Dickinson--------	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Soil blowing, too sandy.	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
442D2*:						
Tama	Severe: slope.	Slight	Deep to water	Slope	Erodes easily, slope.	Slope, erodes easily.
Dickinson	Severe: slope, seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Soil blowing, too sandy, slope.	Slope.
453 Tuskeego	Slight	Severe: thin layer, wetness.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
484 Lawson	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Erodes easily, wetness.	Wetness, erodes easily.
485 Spillville	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Floods	Favorable	Favorable.
520 Coppock	Moderate: seepage.	Severe: hard to pack, wetness.	Floods, frost action.	Floods, wetness.	Wetness, erodes easily.	Wetness, erodes easily.
539 Perks	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
621 Houghton	Severe: seepage.	Severe: excess humus, ponding.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
687 Watkins	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
687B Watkins	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
688 Koszta	Severe: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
727 Udolpho	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness, erodes easily.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
729B*:						
Nodaway	Moderate: seepage.	Severe: piping.	Deep to water	Floods, erodes easily.	Erodes easily	Erodes easily.
Arenzville	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, floods.	Erodes easily, too sandy.	Erodes easily.
760 Ansgar	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Wetness, erodes easily.	Wetness, erodes easily.
761 Franklin	Moderate: seepage.	Moderate: wetness, piping.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
771B, 771C2 Waubeek	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Rooting depth, slope.	Erodes easily	Erodes easily, rooting depth.
778 Sattre	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth	Too sandy	Rooting depth.
778B Sattre	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth, slope.	Too sandy	Rooting depth.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
792D2---------- Armstrong	Severe: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Slope, percs slowly, wetness.	Percs slowly, slope, wetness.
793---------- Bertrand	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
826---------- Rowley	Moderate: seepage.	Severe: piping, wetness.	Floods, frost action.	Wetness, floods.	Erodes easily, wetness.	Wetness, erodes easily.
876B---------- Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope----------	Erodes easily	Erodes easily.
920---------- Tama	Moderate: seepage.	Severe: thin layer.	Deep to water	Favorable------	Erodes easily	Erodes easily.
920B---------- Tama	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope----------	Erodes easily	Erodes easily.
962---------- Elvira	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Floods, wetness.	Wetness, erodes easily.	Wetness, erodes easily.
974B---------- Bolan	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope----------	Too sandy------	Favorable.
976---------- Raddle	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
993D2*, 993E2*:						
Gara----------	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope----------	Slope.
Armstrong--------	Severe: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Slope, percs slowly, wetness.	Percs slowly, slope, wetness.
1119---------- Muscatine	Moderate: seepage.	Moderate: wetness.	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
1160---------- Walford	Slight---------	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.	Wetness, percs slowly, erodes easily.
1220---------- Nodaway	Moderate: seepage.	Severe: piping.	Deep to water	Floods, erodes easily.	Erodes easily	Erodes easily.
1280---------- Mahaska	Moderate: seepage.	Moderate: wetness, hard to pack.	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
1291---------- Atterberry	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Erodes easily, wetness.	Wetness, erodes easily.
1315*:						
Perks----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Spillville-------	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Floods---------	Favorable------	Favorable.
1316*. Fluvaquents						

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1484---------- Lawson	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Erodes easily, wetness.	Wetness, erodes easily.
1485---------- Spillville	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Floods----------	Favorable------	Favorable.
2422*:						
Amana----------	Moderate: seepage.	Moderate: wetness.	Deep to water	Floods, erodes easily.	Erodes easily	Erodes easily.
Lawson----------	Moderate: seepage.	Severe: wetness.	Floods, frost action.	Wetness, floods.	Erodes easily, wetness.	Wetness, erodes easily.
Perks----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
5040*. Orthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
7----------	0-20	Silt loam--------	CL	A-6	0	100	100	100	90-95	30-40	10-20
Wiota	20-49	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	15-25
	49-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
11B*:											
Colo----------	0-42	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	42-60	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
Ely----------	0-26	Silt loam--------	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	26-57	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	57-60	Silt loam, loam	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
41, 41B, 41C, 41D----------	0-27	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
Sparta	27-35	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	35-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
43----------	0-18	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-40
Bremer	18-37	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
	37-60	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	40-60	25-40
54----------	0-39	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
Zook	39-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
63B, 63C, 63E----	0-5	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
Chelsea	5-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
65D2, 65E2, 65F, 65F2----------	0-7	Loam----------	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	50-65	15-30	5-15
Lindley	7-41	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	15-25
	41-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	30-40	15-25
75----------	0-11	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
Givin	11-52	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	45-60	25-35
	52-60	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
76B, 76C2, 76D2--	0-10	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
Ladoga	10-49	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	49-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
80B, 80C, 80C2, 80D, 80D2-------	0-16	Silt loam--------	ML	A-4	0	100	100	100	95-100	30-40	5-10
Clinton	16-52	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	52-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
80D3----------	0-9	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
Clinton	9-52	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	52-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
83B, 83C2--------- Kenyon	0-18	Loam----------	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	18-53	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	53-60	Loam----------	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20
88---------- Nevin	0-22	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
	22-46	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	46-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
110B, 110C, 110E- Lamont	0-10	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	10-33	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	33-60	Fine sandy loam, loam, fine sand.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
118---------- Garwin	0-20	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	20-39	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	39-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	15-20
119, 119B-------- Muscatine	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	7-40	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	40-60	Silt loam--------	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
120B, 120C, 120C2, 120D2---- Tama	0-17	Silt loam--------	ML	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	17-43	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
122---------- Sperry	0-20	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	20-51	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	51-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	20-30
133---------- Colo	0-42	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	42-60	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
133+---------- Colo	0-15	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	15-42	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	42-60	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
135---------- Coland	0-8	Silty clay loam	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	8-55	Clay loam, silty clay loam.	CL, CH	A-7	0	100	100	95-100	65-80	45-55	20-30
	55-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-100	60-70	40-60	20-40	5-15
140---------- Sparta	0-27	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	27-35	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	35-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
141---------- Watseka	0-18	Loamy fine sand	SM, SM-SC	A-2	0	100	95-100	80-100	17-35	<25	NP-5
	18-60	Fine sand, sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2	0	90-100	90-100	60-80	3-25	<20	NP-4

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
152---------- Marshan	0-17	Loam----------	ML, CL	A-6, A-4	0	95-100	95-100	95-100	60-90	30-40	5-15
	17-35	Silty clay loam, clay loam, loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	35-60	Coarse sand, gravelly coarse sand, sand.	SP, SW	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
160---------- Walford	0-8	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-35	11-15
	8-13	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	13-56	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	56-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	35-40	15-20
161*:											
Walford---------	0-8	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-35	11-15
	8-13	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	13-56	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	56-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	35-40	15-20
Atterberry------	0-12	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	12-51	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	95-100	35-55	20-30
	51-60	Silt loam---------	CL	A-6	0	100	100	95-100	95-100	30-40	11-20
162B, 162C, 162C2, 162D2---- Downs	0-7	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	7-37	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	37-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	11-20
163B, 163C, 163C2, 163D, 163D2---------- Fayette	0-10	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	47-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	11-20
163D3---------- Fayette	0-10	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	10-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	47-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	11-20
163E, 163E2------ Fayette	0-10	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	47-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	11-20
163E3---------- Fayette	0-10	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	10-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	47-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	11-20
163F, 163F2, 163G---------- Fayette	0-10	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	47-60	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	11-20
165---------- Stronghurst	0-12	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-35	5-15
	12-46	Silty clay loam	CL	A-7	0	100	100	100	98-100	41-50	19-28
	46-60	Silt loam---------	CL, CL-ML	A-6, A-4	0	100	100	98-100	95-100	26-37	5-15
171B, 171C2, 171D2, 171D3---- Bassett	0-18	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	18-52	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
	52-60	Loam----------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
173---------- Hoopeston	0-35	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	90-100	90-100	70-90	25-45	20-35	NP-10
	35-60	Loamy sand, sand	SP-SM, SM, SC, SM-SC	A-2, A-3	0	90-100	90-100	50-80	5-20	<25	NP-10
174B---------- Bolan	0-20	Loam----------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	20-27	Loam----------	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	27-36	Sandy loam-------	SM-SC, SC	A-4	0	100	100	80-90	35-50	15-25	2-8
	36-60	Loamy fine sand, sand.	SM, SP-SM	A-2	0	100	100	70-85	10-30	---	NP
175, 175B, 175C-- Dickinson	0-16	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	16-30	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	30-36	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	36-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
178---------- Waukee	0-19	Loam----------	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	19-38	Loam, sandy clay loam.	CL, SM-SC, SC, CL-ML	A-6, A-4	0-5	85-95	80-95	65-85	40-60	20-35	5-15
	38-60	Sand, loamy sand, fine sand.	SW, SM, SP-SM, SP	A-1	2-10	60-90	60-85	20-40	3-25	---	NP
179D2, 179E2----- Gara	0-7	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	7-48	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	48-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
184---------- Klinger	0-18	Silty clay loam	CL, ML	A-7	0	100	100	100	95-100	40-50	15-25
	18-34	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	34-60	Loam, clay loam	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
220---------- Nodaway	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
226---------- Lawler	0-14	Loam----------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	14-34	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	34-60	Stratified sandy loam to gravelly coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
279---------- Taintor	0-17	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-60	20-30
	17-65	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-35
	65-70	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
280---------- Mahaska	0-20	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	20-57	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	57-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-20
281B, 281C2, 281D2---------- Otley	0-19	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	19-47	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	47-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
284---------- Flagler	0-20	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	60-70	25-40	15-25	5-10
	20-37	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	50-70	25-40	15-25	5-10
	37-60	Loamy sand, gravelly sand.	SP-SM, SW, SP, SW-SM	A-1	0-5	70-90	70-85	20-40	3-12	---	NP
285C---------- Burkhardt	0-13	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	95-100	60-70	25-40	<20	2-7
	13-20	Sandy loam, loam	SM, ML, SC, CL	A-2, A-4	0	95-100	85-100	60-95	25-60	15-30	2-10
	20-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1	0	50-75	45-75	20-35	1-5	---	NP
291, 291B-------- Atterberry	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	12-51	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	95-100	35-55	20-30
	51-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
293C*, 293C2*, 293D*, 293D2*, 293E*, 293E2*, 293F*, 293G*: Chelsea--------	0-5	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	5-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
Lamont---------	0-10	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	10-33	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	33-60	Fine sandy loam, loam, fine sand.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
Fayette--------	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	47-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
320---------- Arenzville	0-33	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	80-90	25-35	5-10
	33-60	Silt loam, silty clay loam, fine sandy loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	80-95	20-45	5-20
350B---------- Waukegan	0-14	Silt loam--------	ML	A-4	0	95-100	95-100	95-100	85-95	25-40	3-10
	14-37	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	85-95	25-40	5-15
	37-60	Gravelly coarse sand, gravelly loamy sand, sand	SP, SW, SP-SM	A-1	0-2	80-95	65-85	30-50	3-10	---	NP
352B, 352C2------ Whittier	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-95	25-35	5-15
	9-30	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
	30-36	Loam, sandy loam	CL, SC	A-6, A-4	0	100	95-100	80-90	45-75	25-40	8-20
	36-60	Loamy fine sand, fine sand, sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	95-100	80-90	5-20	<20	NP-5
377B, 377C2------ Dinsdale	0-16	Silty clay loam	ML, CL	A-6, A-7	0	100	100	100	95-100	30-50	10-20
	16-33	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	33-60	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
382---------- Maxfield	0-22	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	22-38	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	38-60	Loam----------	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
420B---------- Tama	0-17	Silt loam--------	ML	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	17-43	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
422---------- Amana	0-19	Silt loam--------	CL	A-6	0	100	100	95-100	90-95	25-40	10-20
	19-44	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
	44-60	Silt loam--------	CL	A-6	0	100	100	95-100	75-95	30-40	10-20
428B---------- Ely	0-18	Silt loam--------	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	18-57	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	57-60	Silt loam, clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
430---------- Ackmore	0-27	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	27-60	Silty clay loam, silt loam.	CH, CL, MH, ML	A-7, A-6	0	100	100	95-100	85-100	35-60	15-30
442B*, 442C2*, 442D2*: Tama----------	0-17	Silt loam--------	ML	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	17-43	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	43-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
Dickinson------	0-16	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	16-30	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	30-36	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	36-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
453---------- Tuskeego	0-19	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	98-100	95-100	25-35	5-15
	19-52	Silty clay loam, silty clay, clay loam.	CH	A-7	0	100	100	98-100	95-100	50-60	25-35
	52-60	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	98-100	95-100	45-55	25-35
484---------- Lawson	0-31	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	5-10
	31-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	80-100	20-40	10-25
485---------- Spillville	0-47	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	47-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
520---------- Coppock	0-7	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	7-24	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	24-50	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	95-100	35-55	15-25
	50-60	Silty clay loam	CL, CH	A-7	0	100	100	98-100	95-100	40-60	15-30
539---------- Perks	0-8	Sandy loam-------	SM, SM-SC, SC	A-4	0	100	100	75-80	35-50	15-30	NP-10
	8-60	Sand, loamy sand	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
621---------- Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
687, 687B-------- Watkins	0-9	Silt loam---------	CL, CL-ML	A-6, A-4	0	100	100	95-100	85-95	25-35	5-15
	9-48	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-45	10-20
	48-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
688-------------- Koszta	0-13	Silt loam---------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
	13-60	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-50	20-30
727-------------- Udolpho	0-14	Loam--------------	CL, ML	A-6, A-7	0	100	100	90-100	70-95	30-50	10-20
	14-33	Loam, sandy loam, clay loam.	CL, ML	A-6, A-7	0-2	95-100	85-100	80-95	60-85	30-50	10-20
	33-60	Coarse sand, sand, gravelly coarse sand.	SP, SP-SM, SW	A-1	0-3	75-90	45-85	20-45	0-10	---	NP
729B*: Nodaway----------	0-60	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Arenzville------	0-33	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	95-100	80-90	25-35	5-10
	33-60	Silt loam, silty clay loam, fine sandy loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	80-95	20-45	5-20
760-------------- Ansgar	0-15	Silt loam---------	CL-ML, CL, ML	A-4, A-6, A-7	0	100	100	100	95-100	25-35	5-15
	15-39	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	39-60	Loam, sandy clay loam, clay loam.	CL, SC	A-6	2-5	90-95	85-95	75-85	45-65	25-35	10-20
761-------------- Franklin	0-14	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	14-25	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	20-30
	25-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	95-100	90-95	75-85	55-65	25-35	10-20
771B, 771C2------ Waubeek	0-12	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	100	25-35	5-15
	12-35	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	100	40-50	15-25
	35-60	Loam, sandy clay loam, clay loam.	CL	A-6	0-5	90-95	85-95	75-85	50-65	25-35	10-20
778, 778B-------- Sattre	0-12	Loam--------------	CL, CL-ML, ML	A-4	0	100	90-100	70-90	50-75	25-35	5-10
	12-26	Loam, sandy clay loam, clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	40-60	20-35	5-15
	26-60	Sandy loam, sand, loamy sand.	SW, SM, SP, SP-SM	A-1	2-10	60-85	50-70	20-40	3-25	---	NP
792D2------------ Armstrong	0-11	Loam--------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	11-60	Clay loam, clay	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
793-------------- Bertrand	0-8	Silt loam---------	ML	A-4	0	100	100	90-100	80-90	25-35	3-10
	8-47	Silt loam, silty clay loam.	CL	A-6, A-4	0	100	100	90-100	80-95	25-40	7-20
	47-60	Sand, fine sand	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
826-------------- Rowley	0-17	Silt loam---------	CL	A-4, A-6	0	100	100	90-100	70-95	25-35	8-13
	17-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-50	11-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
876B---------- Ladoga	0-10	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	10-49	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	49-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	100	95-100	30-40	15-20
920, 920B-------- Tama	0-18	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	5-15
	18-36	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-25
	36-45	Sandy loam, loam	SM-SC, SC	A-4	0	100	95-100	80-90	35-50	20-30	5-10
	45-60	Loamy fine sand, loamy sand, fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	95-100	80-90	5-20	<20	NP-5
962---------- Elvira	0-17	Silty clay loam	CL, CH	A-7	0	95-100	90-95	90-95	85-95	45-55	20-30
	17-60	Silty clay loam, clay loam.	CL	A-7	0	95-100	90-95	85-95	80-90	40-50	15-25
974B---------- Bolan	0-20	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-75	25-35	5-15
	20-36	Loam, clay loam, sandy loam.	CL, SC, CL-ML	A-4, A-6	2-5	90-95	85-95	80-90	40-60	25-35	5-15
	36-60	Sandy loam, loamy sand, sand.	SC, SM	A-2, A-3	0	100	100	70-90	15-30	---	NP
976---------- Raddle	0-23	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	85-100	25-35	8-15
	23-60	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-30	4-14
993D2*, 993E2*: Gara----------	0-10	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
	10-50	Clay loam, loam	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	50-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Armstrong-------	0-11	Loam----------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	11-60	Clay loam, clay	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
1119---------- Muscatine	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	7-40	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	40-60	Silt loam--------	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
1160---------- Walford	0-8	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-35	10-15
	8-13	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	13-56	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	56-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	35-40	15-20
1220---------- Nodaway	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
1280---------- Mahaska	0-20	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	20-57	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	57-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-20
1291---------- Atterberry	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	12-51	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	95-100	35-55	20-30
	51-60	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
1315*: Perks----------	0-8	Sandy loam-------	SM, SM-SC, SC	A-4	0	100	100	75-80	35-50	15-30	NP-10
	8-60	Sand, loamy sand	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
Spillville------	0-47	Loam----------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	47-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1316*. Fluvaquents											
1484---------- Lawson	0-31	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	5-10
	31-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	80-100	20-40	10-25
1485---------- Spillville	0-47	Loam----------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	47-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SM-SC, SC	A-6, A-4	0	100	95-100	80-90	35-75	20-40	5-15
2422*:											
Amana----------	0-19	Silt loam--------	CL	A-6	0	100	100	95-100	90-95	25-40	10-20
	19-44	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
	44-60	Silt loam--------	CL	A-6	0	100	100	95-100	75-95	30-40	10-20
Lawson----------	0-31	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	5-10
	31-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	80-100	20-40	10-25
Perks----------	0-8	Sandy loam-------	SM, SM-SC, SC	A-4	0	100	100	75-80	35-50	15-30	NP-10
	8-60	Sand, loamy sand	SM, SP, SP-SM	A-1	0	90-100	90-95	30-50	3-20	---	NP
5040*. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
7----------	0-20	24-32	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	3-4
Wiota	20-49	30-36	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	49-60	28-34	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Moderate-----	0.43			
11B*:											
Colo----------	0-42	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7	5-7
	42-60	30-35	1.25-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28			
Ely----------	0-26	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	4-6
	26-57	28-32	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	57-60	20-28	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43			
41, 41B, 41C, 41D----------	0-27	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low----------	0.17	5	2	.5-2
Sparta	27-35	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-6.5	Low----------	0.17			
	35-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.0	Low----------	0.17			
43----------	0-18	25-32	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	5-7
Bremer	18-37	35-42	1.30-1.40	0.2-0.6	0.15-0.17	6.1-6.5	High----------	0.28			
	37-60	32-38	1.40-1.45	0.2-0.6	0.18-0.20	6.1-6.5	High----------	0.28			
54----------	0-39	32-42	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High----------	0.28	5	7	5-7
Zook	39-60	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High----------	0.28			
63B, 63C, 63E----	0-5	8-15	1.50-1.55	6.0-20	0.10-0.15	5.1-7.3	Low----------	0.17	5	2	.5-1
Chelsea	5-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-6.0	Low----------	0.17			
65D2, 65E2, 65F, 65F2----------	0-7	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low----------	0.32	5	6	.5-2
Lindley	7-41	25-35	1.50-1.75	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32			
	41-60	18-32	1.75-1.85	0.2-0.6	0.12-0.16	5.6-7.8	Moderate-----	0.32			
75----------	0-11	18-26	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.32	5	6	2-3
Givin	11-52	36-42	1.30-1.45	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	52-60	27-34	1.40-1.50	0.2-0.6	0.18-0.20	5.1-5.5	Moderate-----	0.43			
76B, 76C2, 76D2--	0-10	18-27	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6	2-3
Ladoga	10-49	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	49-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
80B, 80C, 80C2, 80D, 80D2-------	0-16	16-26	1.30-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37	5	6	1-2
Clinton	16-52	36-42	1.35-1.45	0.2-0.6	0.16-0.20	5.1-6.0	Moderate-----	0.37			
	52-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
80D3----------	0-9	27-34	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37	4	7	.5-1
Clinton	9-52	36-42	1.35-1.45	0.2-0.6	0.16-0.20	5.1-6.0	Moderate-----	0.37			
	52-60	24-35	1.40-1.55	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
83B, 83C2--------	0-18	20-25	1.40-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.28	5	6	3-4
Kenyon	18-53	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.28			
	53-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	5.6-7.8	Low----------	0.37			
88----------	0-22	26-29	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	4-6
Nevin	22-46	30-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	46-60	25-36	1.40-1.45	0.6-2.0	0.18-0.20	6.6-7.3	Moderate-----	0.43			
110B, 110C, 110E-	0-10	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3	.5-1
Lamont	10-33	5-15	1.50-1.55	2.0-6.0	0.14-0.16	4.5-7.3	Low----------	0.24			
	33-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low----------	0.17			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
118----------	0-20	30-35	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7	6-7
Garwin	20-39	28-34	1.28-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28			
	39-60	20-26	1.35-1.45	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.28			
119, 119B--------	0-7	24-27	1.28-1.32	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6	5-6
Muscatine	7-40	27-35	1.28-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43			
	40-60	22-26	1.35-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate-----	0.43			
120B, 120C, 120C2, 120D2----	0-17	24-29	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	7	2-4
Tama	17-43	28-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	43-60	22-28	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
122----------	0-20	18-22	1.35-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6	3-4
Sperry	20-51	38-45	1.40-1.45	0.06-0.2	0.14-0.16	5.1-6.5	High----------	0.43			
	51-60	26-34	1.45-1.50	0.2-0.6	0.19-0.21	5.6-6.5	High----------	0.43			
133----------	0-42	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.28	5	7	5-7
Colo	42-60	30-35	1.25-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28			
133+---------	0-15	20-26	1.25-1.30	0.6-2.0	0.22-0.24	6.6-7.3	Moderate-----	0.28	5	6	3-5
Colo	15-42	30-35	1.25-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28			
	42-60	30-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	High----------	0.28			
135----------	0-8	27-35	1.40-1.50	0.6-2.0	0.20-0.22	5.6-7.3	High----------	0.28	5	7	5-7
Coland	8-55	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	High----------	0.28			
	55-60	12-26	1.50-1.65	2.0-6.0	0.13-0.17	6.1-7.3	Low-----------	0.28			
140----------	0-27	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low-----------	0.17	5	2	1-2
Sparta	27-35	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-6.5	Low-----------	0.17			
	35-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.0	Low-----------	0.17			
141----------	0-18	8-13	1.35-1.55	6.0-20	0.10-0.12	6.1-7.3	Low-----------	0.17	5	2	1-3
Watseka	18-60	1-10	1.70-2.00	6.0-20	0.05-0.10	5.1-7.3	Low-----------	0.17			
152----------	0-17	18-30	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	4	6	4-8
Marshan	17-35	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28			
	35-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low-----------	0.15			
160----------	0-8	20-26	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	2-3
Walford	8-13	18-26	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.43			
	13-56	32-38	1.35-1.40	0.06-0.2	0.18-0.20	5.1-6.5	High----------	0.43			
	56-60	24-27	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.8	Moderate-----	0.43			
161*:											
Walford---------	0-8	20-26	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	2-3
	8-13	18-26	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.43			
	13-56	32-35	1.35-1.40	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.43			
	56-60	24-27	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.8	Moderate-----	0.43			
Atterberry------	0-12	20-26	1.20-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6	2-4
	12-51	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	51-60	20-30	1.35-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43			
162B, 162C, 162C2, 162D2----	0-7	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low-----------	0.32	5	6	1-3
Downs	7-37	26-34	1.30-1.35	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.43			
	37-60	22-26	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
163B, 163C, 163C2, 163D, 163D2----------	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6	.5-2
Fayette	10-47	30-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	47-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
163D3---------- Fayette	0-10	28-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7	0-.5
	10-47	30-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	47-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37			
163E, 163E2------ Fayette	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6	.5-2
	10-47	30-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	47-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37			
163E3---------- Fayette	0-10	28-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37	4	7	0-.5
	10-47	30-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	47-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37			
163F, 163F2, 163G---------- Fayette	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6	.5-2
	10-47	30-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	47-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37			
165---------- Stronghurst	0-12	20-27	1.25-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	12-46	27-35	1.30-1.55	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.37			
	46-60	20-27	1.35-1.60	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
171B, 171C2, 171D2, 171D3---- Bassett	0-18	18-25	1.45-1.50	0.6-2.0	0.19-0.21	5.1-6.5	Low----------	0.28	5-4	6	.5-3
	18-52	20-28	1.55-1.65	0.6-2.0	0.17-0.19	4.5-5.5	Low----------	0.28			
	52-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	5.1-8.4	Low----------	0.37			
173---------- Hoopeston	0-35	8-18	1.35-1.70	2.0-6.0	0.12-0.15	5.1-6.5	Low----------	0.28	4	3	2-3
	35-60	2-10	1.50-1.80	6.0-20	0.05-0.10	5.6-7.8	Low----------	0.28			
174B---------- Bolan	0-20	20-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	4	6	3-4
	20-27	14-20	1.45-1.50	0.6-2.0	0.17-0.19	5.6-6.5	Low----------	0.28			
	27-36	10-15	1.50-1.60	2.0-6.0	0.11-0.13	5.6-7.3	Low----------	0.28			
	36-60	2-8	1.60-1.70	6.0-20	0.08-0.10	5.6-7.3	Low----------	0.17			
175, 175B, 175C-- Dickinson	0-16	12-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.20	4	3	1-2
	16-30	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low----------	0.20			
	30-36	5-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low----------	0.20			
	36-60	5-10	1.60-1.70	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.15			
178---------- Waukee	0-19	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	4	6	3-4
	19-38	18-26	1.40-1.50	0.6-2.0	0.15-0.19	4.5-6.5	Low----------	0.32			
	38-60	2-8	1.50-1.75	>20	0.02-0.06	5.6-7.3	Low----------	0.10			
179D2, 179E2----- Gara	0-7	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6	1-2
	7-48	30-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.28			
	48-60	24-38	1.75-1.85	0.2-0.6	0.16-0.18	6.6-7.8	Moderate-----	0.37			
184---------- Klinger	0-18	26-30	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	6	5-6
	18-34	28-35	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	34-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.6-7.8	Low----------	0.43			
220---------- Nodaway	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6	2-3
226---------- Lawler	0-14	18-28	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	4	6	4-5
	14-34	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low----------	0.28			
	34-60	2-12	1.60-1.75	>20	0.02-0.04	5.1-6.5	Low----------	0.10			
279---------- Taintor	0-17	30-36	1.30-1.40	0.2-0.6	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	4-6
	17-65	35-44	1.30-1.45	0.2-0.6	0.14-0.18	5.6-7.3	High---------	0.43			
	65-70	24-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43			
280---------- Mahaska	0-20	20-32	1.30-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7	5-6
	20-57	36-42	1.30-1.45	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.43			
	57-60	24-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
281B, 281C2, 281D2----------	0-19	28-34	1.25-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7	3-4
Otley	19-47	34-42	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	47-60	24-35	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
284----------	0-20	12-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low----------	0.20	4	3	1-2
Flagler	20-37	10-15	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low----------	0.20			
	37-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low----------	0.20			
285C----------	0-13	5-12	1.35-1.55	2.0-6.0	0.13-0.15	5.1-7.3	Low----------	0.20	3	3	1-2
Burkhardt	13-20	8-18	1.55-1.65	2.0-6.0	0.12-0.19	5.1-6.5	Low----------	0.20			
	20-60	1-6	1.50-1.60	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.10			
291, 291B--------	0-12	20-26	1.20-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.32	5	6	2-4
Atterberry	12-51	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	51-60	20-30	1.35-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
293C*, 293C2*, 293D*, 293D2*, 293E*, 293E2*, 293F*, 293G*:											
Chelsea--------	0-5	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low----------	0.17	5	2	.5-1
	5-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low----------	0.17			
Lamont---------	0-10	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3	.5-1
	10-33	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low----------	0.24			
	33-60	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low----------	0.24			
Fayette--------	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6	1-2
	10-47	30-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	47-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37			
320----------	0-33	5-18	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.37	5	5	1-3
Arenzville	33-60	20-30	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Moderate-----	0.37			
350B----------	0-14	18-27	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	4	6	2-5
Waukegan	14-37	18-27	1.35-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43			
	37-60	1-10	1.50-1.70	6.0-20	0.02-0.04	5.6-7.8	Low----------	0.10			
352B, 352C2------	0-9	18-24	1.25-1.30	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.32	4	6	1-3
Whittier	9-30	28-32	1.30-1.40	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.43			
	30-36	12-18	1.50-1.60	0.6-2.0	0.16-0.18	5.1-6.0	Low----------	0.43			
	36-60	2-10	1.60-1.70	6.0-20	0.04-0.07	5.1-6.5	Low----------	0.17			
377B, 377C2------	0-16	25-29	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7	2-5
Dinsdale	16-33	30-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	33-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.6-8.4	Low----------	0.43			
382----------	0-22	30-35	1.35-1.40	0.6-2.0	0.21-0.23	6.6-7.3	High---------	0.24	5	6	6-7
Maxfield	22-38	25-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.32			
	38-60	20-26	1.65-1.85	0.6-2.0	0.17-0.19	6.1-7.8	Low----------	0.32			
420B----------	0-17	24-29	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	7	3-4
Tama	17-43	28-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	43-60	22-28	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
422----------	0-19	18-30	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.37	5	6	4-5
Amana	19-44	18-30	1.25-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Moderate-----	0.37			
	44-60	18-26	1.25-1.40	0.6-2.0	0.20-0.22	5.6-6.5	Moderate-----	0.37			
428B----------	0-18	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	4-6
Ely	18-57	28-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	57-60	20-28	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43			
430----------	0-27	25-30	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.37	5	6	2-4
Ackmore	27-60	26-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	High---------	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
442B*, 442C2*, 442D2*:											
Tama	0-17	24-29	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate	0.32	5	7	3-4
	17-43	28-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	0.43			
	43-60	22-28	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.43			
Dickinson	0-16	12-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low	0.20	4	3	1-2
	16-30	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low	0.20			
	30-36	5-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low	0.20			
	36-60	5-10	1.60-1.70	6.0-20	0.02-0.04	5.6-6.5	Low	0.15			
453	0-19	16-22	1.35-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Moderate	0.32	3	7	2-3
Tuskeego	19-52	32-48	1.30-1.45	<0.06	0.13-0.17	5.1-7.3	High	0.32			
	52-60	28-40	1.40-1.50	0.06-0.2	0.16-0.19	5.6-7.3	Moderate	0.32			
484	0-31	10-26	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low	0.32	5	5	3-5
Lawson	31-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	5.6-7.8	Moderate	0.43			
485	0-47	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.28	5	6	4-6
Spillville	47-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low	0.28			
520	0-7	16-26	1.30-1.35	0.6-2.0	0.20-0.24	6.1-7.3	Moderate	0.32	5	7	2-3
Coppock	7-24	16-27	1.30-1.40	0.6-2.0	0.18-0.22	5.6-7.3	Moderate	0.43			
	24-50	27-35	1.30-1.40	0.6-2.0	0.17-0.21	4.5-6.0	Moderate	0.43			
	50-60	27-40	1.40-1.45	0.6-2.0	0.15-0.19	4.5-6.0	Moderate	0.43			
539	0-8	10-15	1.50-1.55	2.0-6.0	0.12-0.15	5.6-6.5	Low	0.20	5	3	.5-1
Perks	8-60	2-10	1.50-1.75	6.0-20	0.02-0.04	5.6-6.5	Low	0.15			
621	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	---	---	---	3	>70
Houghton											
687, 687B	0-9	18-24	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate	0.32	5	7	2-3
Watkins	9-48	25-35	1.35-1.40	0.6-2.0	0.15-0.19	5.1-7.3	Moderate	0.43			
	48-60	25-32	1.40-1.45	0.6-2.0	0.14-0.18	5.1-6.5	Moderate	0.43			
688	0-13	18-24	1.30-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Moderate	0.32	5	7	2-3
Koszta	13-60	27-37	1.30-1.45	0.6-2.0	0.15-0.19	5.1-7.3	Moderate	0.43			
727	0-14	18-27	1.30-1.50	0.6-2.0	0.20-0.24	5.1-6.5	Moderate	0.37	5	6	2-4
Udolpho	14-33	18-30	1.40-1.55	0.6-2.0	0.16-0.22	5.1-6.5	Moderate	0.37			
	33-60	<5	1.55-1.65	6.0-20	0.02-0.08	4.5-7.8	Low	0.15			
729B*:											
Nodaway	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate	0.37	5	6	2-3
Arenzville	0-33	5-18	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low	0.37	5	5	1-3
	33-60	20-30	1.20-1.40	0.6-2.0	0.12-0.16	5.6-7.8	Low	0.37			
760	0-15	18-25	1.30-1.35	0.6-2.0	0.21-0.23	5.1-7.3	Moderate	0.32	5	6	2-3
Ansgar	15-39	30-35	1.35-1.40	0.6-2.0	0.18-0.20	5.1-6.0	High	0.43			
	39-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.43			
761	0-14	18-25	1.30-1.35	0.6-2.0	0.21-0.23	4.5-7.3	Moderate	0.32	5	6	2-3
Franklin	14-25	30-34	1.35-1.40	0.6-2.0	0.18-0.20	4.5-6.0	Moderate	0.43			
	25-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-7.8	Low	0.43			
771B, 771C2	0-12	19-24	1.25-1.30	2.0-6.0	0.21-0.23	5.6-7.3	Moderate	0.32	5-4	6	1-3
Waubeek	12-35	25-34	1.25-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.43			
	35-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.43			
778, 778B	0-12	18-24	1.40-1.45	0.6-2.0	0.18-0.20	6.1-6.5	Low	0.28	4	6	2-3
Sattre	12-26	15-28	1.40-1.50	0.6-6.0	0.15-0.17	5.1-6.0	Low	0.28			
	26-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.0	Low	0.15			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
792D2---------- Armstrong	0-11	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6	1-3
	11-60	30-36	1.55-1.75	0.06-0.6	0.14-0.16	4.5-6.5	Moderate-----	0.32			
793---------- Bertrand	0-8	15-22	1.35-1.60	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	1-3
	8-47	18-30	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.37			
	47-60	1-4	1.55-1.65	6.0-20	0.05-0.07	5.1-6.5	Low----------	0.15			
826---------- Rowley	0-17	15-22	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.32	5	5	2-5
	17-60	20-30	1.35-1.65	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.43			
876B---------- Ladoga	0-10	18-27	1.30-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6	2-3
	10-49	36-42	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	49-60	24-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
920, 920B-------- Tama	0-18	24-28	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	7	3-4
	18-36	28-34	1.30-1.35	0.6-2.0	0.19-0.22	5.1-6.0	Moderate-----	0.43			
	36-45	15-20	1.30-1.35	2.0-6.0	0.11-0.17	5.1-6.5	Low----------	0.24			
	45-60	3-10	1.30-1.35	6.0-20	0.05-0.10	5.1-7.3	Low----------	0.24			
962---------- Elvira	0-17	26-34	1.25-1.35	0.6-2.0	0.20-0.22	5.6-7.3	High---------	0.28	5	7	5-7
	17-60	28-35	1.35-1.45	0.6-2.0	0.17-0.19	5.6-7.3	High---------	0.43			
974B---------- Bolan	0-20	20-26	1.40-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.32	4	6	3-4
	20-36	14-20	1.45-1.50	0.6-2.0	0.17-0.19	5.1-6.5	Low----------	0.32			
	36-60	10-15	1.50-1.60	2.0-20	0.08-0.13	5.6-6.0	Low----------	0.17			
976---------- Raddle	0-23	18-24	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5-4	6	2-5
	23-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
993D2*, 993E2*: Gara----------	0-10	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.28	5	6	1-2
	10-50	30-38	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.28			
	50-60	24-38	1.75-1.85	0.2-0.6	0.16-0.18	6.6-7.8	Moderate-----	0.37			
Armstrong-------	0-11	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6	1-3
	11-60	30-36	1.55-1.75	0.06-0.6	0.14-0.16	5.1-6.5	Moderate-----	0.32			
1119---------- Muscatine	0-7	24-27	1.28-1.32	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6	5-6
	7-40	30-34	1.28-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43			
	40-60	22-26	1.35-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate-----	0.43			
1160---------- Walford	0-8	20-26	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	6	2-3
	8-13	18-26	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43			
	13-56	32-35	1.35-1.40	0.06-0.2	0.18-0.20	5.1-6.0	High---------	0.43			
	56-60	24-27	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.8	Moderate-----	0.43			
1220---------- Nodaway	0-60	18-28	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6	2-3
1280---------- Mahaska	0-20	20-32	1.30-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	7	5-6
	20-57	36-42	1.30-1.45	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.43			
	57-60	24-32	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
1291---------- Atterberry	0-12	20-26	1.20-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6	2-4
	12-51	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	51-60	20-30	1.35-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
1315*: Perks----------	0-8	10-15	1.50-1.55	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.20	5	3	.5-2
	8-60	2-10	1.50-1.75	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.15			
Spillville------	0-47	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6	4-6
	47-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
1316*. Fluvaquents											
1484---------- Lawson	0-31	10-20	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.32	5	5	3-5
	31-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43			
1485---------- Spillville	0-47	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6	4-6
	47-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28			
2422*: Amana----------	0-19	18-30	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.37	5	6	4-5
	19-44	18-30	1.25-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Moderate-----	0.37			
	44-60	18-26	1.25-1.40	0.6-2.0	0.20-0.22	5.6-6.5	Moderate-----	0.37			
Lawson----------	0-31	10-20	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.32	5	5	3-5
	31-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43			
Perks----------	0-8	10-15	1.50-1.55	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.20	5	3	.5-1
	8-60	2-10	1.50-1.75	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.15			
5040*. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
7---------- Wiota	B	Rare--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
11B*: Colo----------	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
Ely----------	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
41, 41B, 41C, 41D- Sparta	A	None--------	---	---	>6.0	---	---	Low------	Low------	Moderate.
43---------- Bremer	C	Rare--------	---	---	1.0-2.0	Apparent	Nov-Jul	High-----	Moderate	Moderate.
54---------- Zook	C/D	Occasional	Brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-May	High-----	High-----	Moderate.
63B, 63C, 63E----- Chelsea	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
65D2, 65E2, 65F, 65F2---------- Lindley	C	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
75---------- Givin	C	None--------	---	---	2.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
76B, 76C2, 76D2--- Ladoga	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
80B, 80C, 80C2, 80D, 80D2, 80D3-- Clinton	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
83B, 83C2--------- Kenyon	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
88---------- Nevin	B	Rare--------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Low.
110B, 110C, 110E-- Lamont	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
118---------- Garwin	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
119, 119B--------- Muscatine	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
120B, 120C, 120C2, 120D2---------- Tama	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
122---------- Sperry	C/D	None--------	---	---	+1-1.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
133---------- Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
133+---------- Colo	B/D	Frequent----	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
135---------- Coland	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Low.
140---------- Sparta	A	None--------	---	---	>6.0	---	---	Low------	Low------	Moderate.
141---------- Watseka	B	None--------	---	---	1.0-3.0	Apparent	Feb-May	Moderate	Low------	High.
152---------- Marshan	B/D	Rare--------	---	---	1.0-2.5	Apparent	Oct-Jun	High-----	High-----	Moderate.
160---------- Walford	B/D	None--------	---	---	0-2.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
161*:										
Walford----------	B/D	None--------	---	---	0-2.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
Atterberry-------	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	High-----	High-----	Moderate.
162B, 162C, 162C2, 162D2---------- Downs	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
163B, 163C, 163C2, 163D, 163D2, 163D3, 163E, 163E2, 163E3, 163F, 163F2, 163G---------- Fayette	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
165---------- Stronghurst	B	None--------	---	---	1.0-3.0	Apparent	Apr-Jun	High-----	High-----	Moderate.
171B, 171C2, 171D2, 171D3----- Bassett	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
173---------- Hoopeston	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	High-----	Low------	Moderate.
174B---------- Bolan	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
175, 175B, 175C--- Dickinson	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
178---------- Waukee	B	None--------	---	---	>6.0	---	---	Low------	Low------	Moderate.
179D2, 179E2------ Gara	C	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
184---------- Klinger	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
220---------- Nodaway	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	High-----	Moderate	Low.
226---------- Lawler	B	None--------	---	---	2.0-4.0	Apparent	Nov-May	High-----	High-----	Moderate.
279---------- Taintor	C/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
280---------- Mahaska	B	None--------	---	---	2.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
281B, 281C2, 281D2---------- Otley	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
284---------- Flagler	B	None to rare	---	---	>6.0	---	---	Low-------	Moderate	Low.
285C---------- Burkhardt	B	None--------	---	---	>6.0	---	---	Low-------	Low-------	High.
291, 291B--------- Atterberry	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	High------	High------	Moderate.
293C*, 293C2*, 293D*, 293D2*, 293E*, 293E2*, 293F*, 293G*:										
Chelsea---------	A	None--------	---	---	>6.0	---	---	Low-------	Low-------	Low.
Lamont----------	B	None--------	---	---	>6.0	---	---	Moderate	Low-------	Moderate.
Fayette---------	B	None--------	---	---	>6.0	---	---	High------	Moderate	Moderate.
320---------- Arenzville	B	Frequent----	Brief-----	Feb-Nov	3.0-6.0	Apparent	Nov-Jun	High------	Moderate	Moderate.
350B---------- Waukegan	B	None--------	---	---	>6.0	---	---	Low-------	Low-------	Moderate.
352B, 352C2------- Whittier	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
377B, 377C2------- Dinsdale	B	None--------	---	---	>6.0	---	---	High------	Moderate	Moderate.
382---------- Maxfield	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	High------	High------	Moderate.
420B---------- Tama	B	None--------	---	---	>6.0	---	---	High------	Moderate	Moderate.
422---------- Amana	B	Occasional	Brief-----	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High------	High------	Moderate.
428B---------- Ely	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	High------	High------	Moderate.
430---------- Ackmore	B	Frequent----	Very brief to brief.	Sep-Jun	1.0-3.0	Apparent	Nov-Jul	High------	High------	Low.
442B*, 442C2*, 442D2*:										
Tama----------	B	None--------	---	---	>6.0	---	---	High------	Moderate	Moderate.
Dickinson-------	B	None--------	---	---	>6.0	---	---	Moderate	Low-------	Moderate.
453---------- Tuskeego	C/D	Rare--------	---	---	0-1.0	Apparent	Nov-Jul	Moderate	High------	Moderate.
484---------- Lawson	C	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-May	High------	Moderate	Low.
485---------- Spillville	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	Moderate	High------	Moderate.
520---------- Coppock	B	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High------	High------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
539---------- Perks	A	Occasional	Very brief to brief.	Feb-Nov	>6.0	---	---	Low------	Low------	Moderate.
621---------- Houghton	A/D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	High-----	High-----	Low.
687, 687B---------- Watkins	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
688---------- Koszta	B	Rare--------	---	---	2.0-3.0	Apparent	Nov-Jul	High-----	Moderate	Moderate.
727---------- Udolpho	B/D	None--------	---	---	1.0-3.0	Apparent	Oct-Jun	High-----	Moderate	Moderate.
729B*: Nodaway----------	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	High-----	Moderate	Low.
Arenzville-------	B	Frequent----	Brief-----	Feb-Nov	3.0-6.0	Apparent	Nov-Jun	High-----	Moderate	Moderate.
760---------- Ansgar	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
761---------- Franklin	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
771B, 771C2------- Waubeek	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
778, 778B---------- Sattre	B	None--------	---	---	>6.0	---	---	Low------	Low------	High.
792D2---------- Armstrong	D	None--------	---	---	1.0-3.0	Perched	Nov-Jul	High-----	High-----	Moderate.
793---------- Bertrand	B	None--------	---	---	>6.0	---	---	High-----	Low------	Moderate.
826---------- Rowley	C	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-May	High-----	High-----	Moderate.
876B---------- Ladoga	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
920, 920B---------- Tama	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
962---------- Elvira	B/D	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
974B---------- Bolan	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
976---------- Raddle	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
993D2*, 993E2*: Gara----------	C	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Armstrong--------	D	None--------	---	---	1.0-3.0	Perched	Nov-Jul	High-----	High-----	Moderate.
1119---------- Muscatine	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
1160---------- Walford	B/D	None--------	---	---	0-2.0	Apparent	Nov-Jul	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
1220---------- Nodaway	B	Frequent----	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	High-----	Moderate	Low.
1280---------- Mahaska	B	None--------	---	---	2.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
1291---------- Atterberry	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	High-----	High-----	Moderate.
1315*:										
Perks----------	A	Occasional	Very brief to brief.	Feb-Nov	>6.0	---	---	Low------	Low------	Moderate.
Spillville-------	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	Moderate	High-----	Moderate.
1316*. Fluvaquents										
1484---------- Lawson	C	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-May	High-----	Moderate	Low.
1485---------- Spillville	B	Frequent----	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	Moderate	High-----	Moderate.
2422*:										
Amana----------	B	Frequent----	Brief-----	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
Lawson----------	C	Frequent----	Brief-----	Mar-Nov	1.0-3.0	Apparent	Nov-May	High-----	Moderate	Low.
Perks----------	A	Frequent----	Very brief to brief.	Feb-Nov	>6.0	---	---	Low------	Low------	Moderate.
5040*. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Amana	Fine-silty, mixed, mesic Aquic Hapludolls
Ansgar	Fine-silty, mixed, mesic Mollic Ochraqualfs
Arenzville	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Armstrong	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Atterberry	Fine-silty, mixed, mesic Udollic Ochraqualfs
Bassett	Fine-loamy, mixed, mesic Mollic Hapludalfs
Bertrand	Fine-silty, mixed, mesic Typic Hapludalfs
Bolan	Coarse-loamy, mixed, mesic Typic Hapludolls
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
Burkhardt	Sandy, mixed, mesic Typic Hapludolls
Chelsea	Mixed, mesic Alfic Udipsamments
Clinton	Fine, montmorillonitic, mesic Typic Hapludalfs
Coland	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Coppock	Fine-silty, mixed, mesic Mollic Ochraqualfs
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dinsdale	Fine-silty, mixed, mesic Typic Argiudolls
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Elvira	Fine-silty, mixed, mesic Typic Haplaquolls
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
Flagler	Coarse-loamy, mixed, mesic Typic Hapludolls
Fluvaquents	Loamy and clayey, mixed, mesic Typic Fluvaquents
Franklin	Fine-silty, mixed, mesic Udollic Ochraqualfs
Gara	Fine-loamy, mixed, mesic Mollic Hapludalfs
Garwin	Fine-silty, mixed, mesic Typic Haplaquolls
Givin	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Hoopeston	Coarse-loamy, mixed, mesic Aquic Hapludolls
Houghton	Euic, mesic Typic Medisaprists
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Klinger	Fine-silty, mixed, mesic Aquic Hapludolls
Koszta	Fine-silty, mixed, mesic Udollic Ochraqualfs
Ladoga	Fine, montmorillonitic, mesic Mollic Hapludalfs
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lawler	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
Lawson	Fine-silty, mixed, mesic Cumulic Hapludolls
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
Mahaska	Fine, montmorillonitic, mesic Aquic Argiudolls
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Maxfield	Fine-silty, mixed, mesic Typic Haplaquolls
Muscatine	Fine-silty, mixed, mesic Aquic Hapludolls
Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Orthents	Loamy, mixed, mesic Typic Udorthents
Otley	Fine, montmorillonitic, mesic Typic Argiudolls
Perks	Mixed, mesic Typic Udipsamments
Raddle	Fine-silty, mixed, mesic Typic Hapludolls
*Rowley	Fine-silty, mixed, mesic Aquic Argiudolls
Sattre	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Sparta	Sandy, mixed, mesic Entic Hapludolls
Sperry	Fine, montmorillonitic, mesic Typic Argialbolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls
Stronghurst	Fine-silty, mixed, mesic Aeric Ochraqualfs
Taintor	Fine, montmorillonitic, mesic Typic Argiaquolls
Tama	Fine-silty, mixed, mesic Typic Argiudolls
Tuskeego	Fine, montmorillonitic, mesic Mollic Ochraqualfs
Udolpho	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Ochraqualfs
Walford	Fine-silty, mixed, mesic Mollic Ochraqualfs
Watkins	Fine-silty, mixed, mesic Mollic Hapludalfs
Watseka	Sandy, mixed, mesic Aquic Hapludolls
Waubeek	Fine-silty, mixed, mesic Mollic Hapludalfs
Waukee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Waukegan	Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Whittier	Fine-silty over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Wiota	Fine-silty, mixed, mesic Typic Argiudolls
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

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