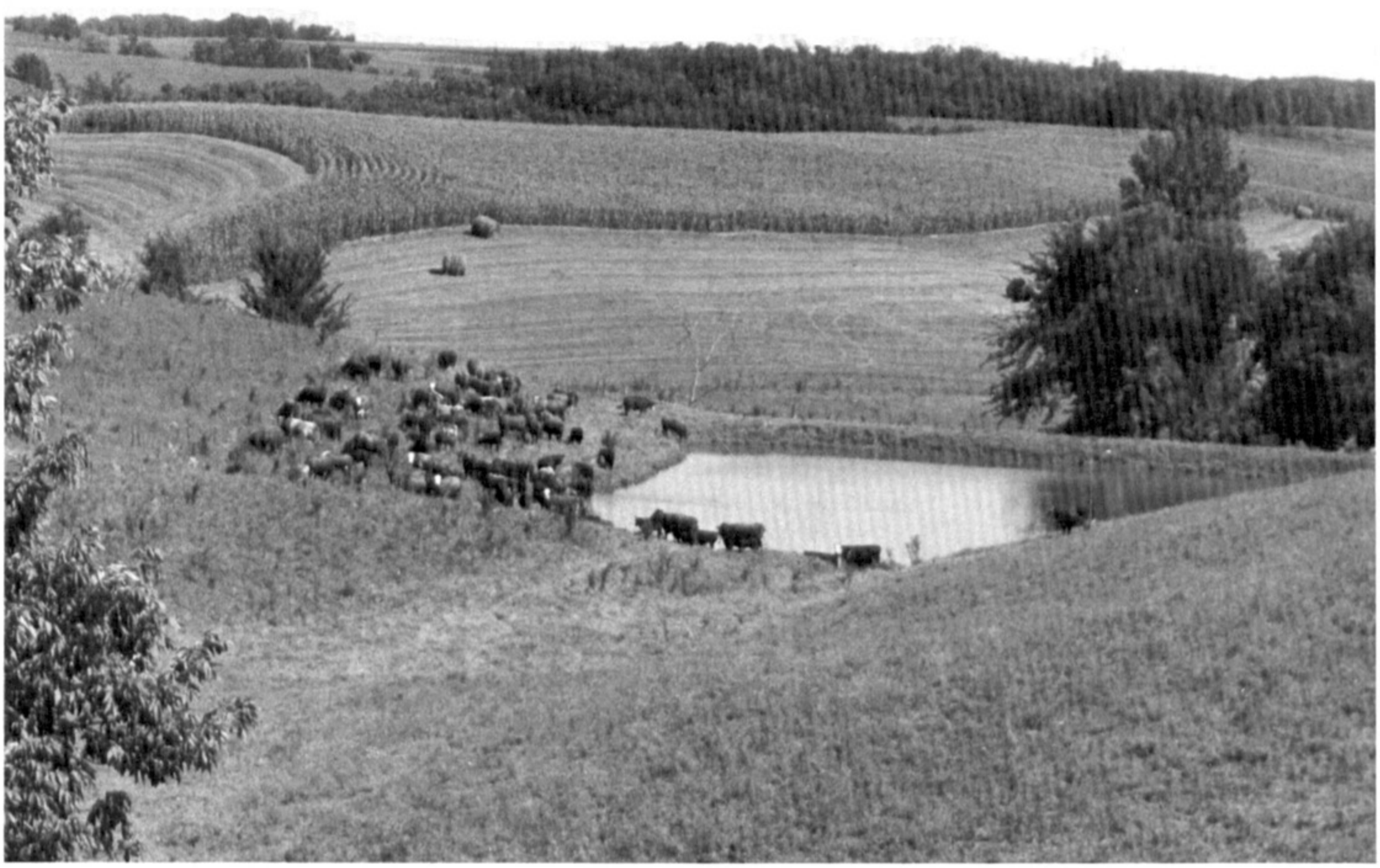
United States
Department of
Agriculture

Soil
Conservation
Service

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

Soil Survey of Jones County, Iowa



How To Use This Soil Survey

General Soil Map

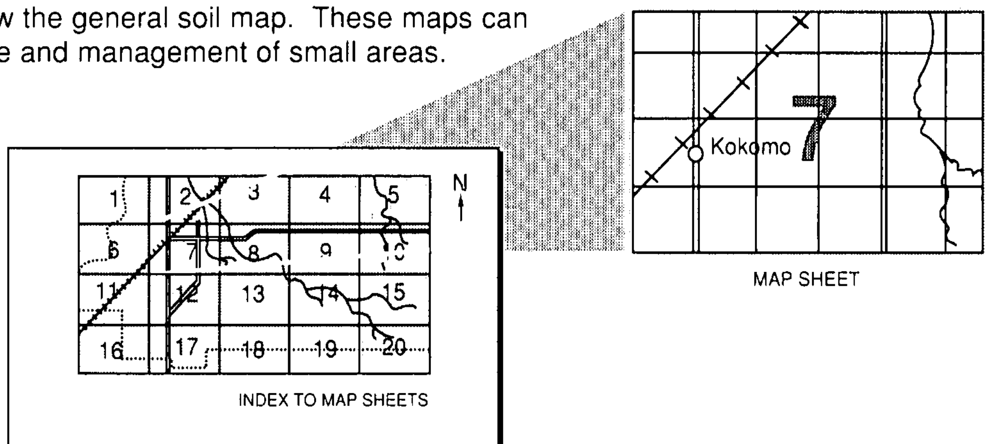
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

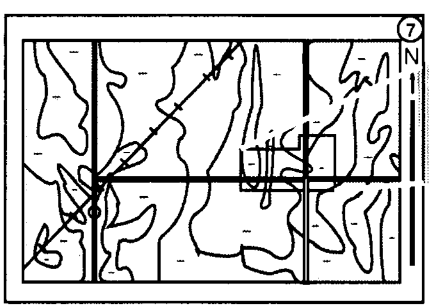
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



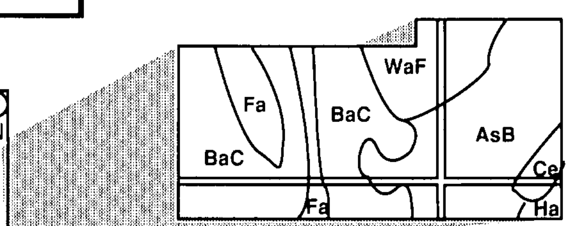
INDEX TO MAP SHEETS

MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed during the period 1981-87. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. It is part of the technical assistance furnished to the Jones County Soil and Water Conservation District. Funds appropriated by Jones County were used to defray part of the cost of the survey.

Cover: Improved pasture in an area of the Fayette-Nordness-Rock outcrop association. The cover of grasses and the farm pond help to control erosion.

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Issued June 1991

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Summary of Tables

Preface

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

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

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

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

Soil Survey of Jones County, Iowa

By Mark J. Minger, Soil Conservation Service

Fieldwork by Mark J. Minger, Jeff Talsky, Kevin Funni, Scott Switzer, and John Lucassen, 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 the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

Jones County is in the east-central part of Iowa (fig. 1). It has a land area of 374,400 acres, or 585 square miles. It is bordered by Delaware and Dubuque Counties on the north, Jackson and Clinton Counties on the east, Cedar County on the south, and Linn County on the west. Anamosa, the county seat, is in the west-central part of the county.

The county is used chiefly for agricultural purposes; about 358,000 acres is farmland. The principal crops are corn, soybeans, oats, legume hay, and pasture. Corn is the most important crop sold, although much of it is fed to livestock. Hogs, beef cattle, and dairy cattle are the principal livestock enterprises. If well managed, most soils are well suited or moderately well suited to crops, pasture, and trees. Water erosion generally is a moderate or severe hazard, and measures are needed to control water erosion, conserve soil moisture, and reduce sedimentation in rivers and streams.

The soil and landscape patterns in the county are complex because of the variety of materials involved in the soil development and the extensive drainage pattern. Most of the soils formed under timber or a mixture of prairie grass and timber, and most formed from loess-mantled glacial till and limestone bedrock. The slopes are typically gently sloping to steep, but nearly level bottom land and stream terraces and very steep upland side slopes are in scattered areas throughout the county. The Maquoketa River, the North Fork of the Maquoketa River, and the Wapsipinicon River are high-gradient streams subject to high-velocity, short-duration flooding in the spring and after periods of heavy rainfall. The topography along these streams and their tributaries mainly is very steep and rugged; some limestone bluffs rise abruptly to a height of 100 to 250 feet above the river.

The first soil survey of Jones County was published in 1928 *(6)*. This survey updates the first survey and

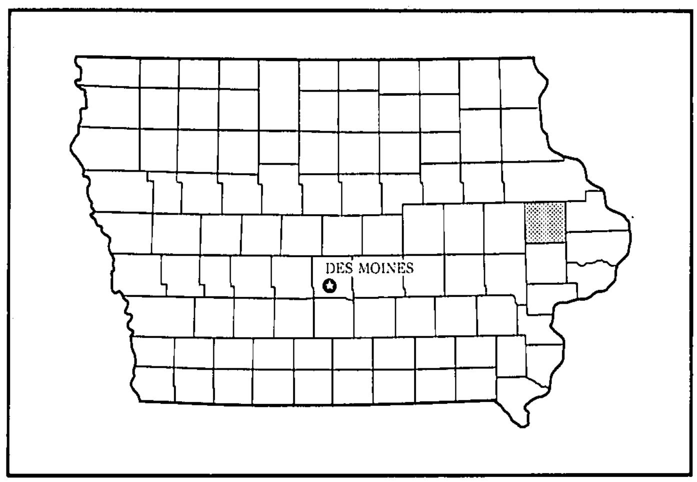

Figure 1.—Location of Jones County in Iowa.

provides additional information and larger maps that show the soils in greater detail.

General Nature of the County

This section describes some of the natural and cultural factors that affect land use in the county.

History and Development

The area that is now Jones County was acquired by the United States in 1803 as a part of the Louisiana Purchase. From 1812 to 1821, the area was part of the Missouri Territory, and from 1821 to 1832, it was considered to be unorganized Indian land. In 1832, under the terms of the Blackhawk Treaty, the area was purchased from the Indians, and 2 years later it became a part of Dubuque County in the Michigan Territory *(1)*.

The first permanent settler in this area was Hugh Bowen, who in 1836 occupied land later known as Bowen's Prairie, which was to become a part of Richland Township. That same year, the area became a part of the Wisconsin Territory. On November 12, 1838, the boundaries of Jones County were established. The county was named for George Jones, the congressional representative for the Wisconsin Territory at that time. The county seat was established at Edinbourgh but was later moved to Newport and finally to Lexington (later renamed Anamosa) in June 1840.

An evenly bedded limestone formation in Jones County, particularly in the Stone City area west of Anamosa, was instrumental in the settlement and development of the area. By 1852, building stone was being quarried from the area and used in building construction in the immediate area, including the Iowa State Men's Reformatory. By 1859, trains were distributing the stone throughout the Midwest. About 156,000 railcars of the stone were shipped from 1859 to 1895.

The 1980 census data show a population of 20,400 in the county. Anamosa, the largest city, had a population of 4,958, and Monticello, the second largest city, had a population of 3,641.

Physiography, Relief, and Drainage

Jones County is mainly a dissected upland drained by the southeastward-flowing Maquoketa and Wapsipinicon Rivers. The county can be divided into four major areas of distinct physiography: the Iowa Erosion Surface, the southern Iowa drift plain, areas that are shallow to bedrock, and alluvial plains.

The area known as the Iowa Erosion Surface is mostly in the northwest corner of the county and southwest of the Wapsipinicon River. Most soils in areas of the erosion surface formed in 1 to 3 feet of the sediments over glacial till. Some areas have a thin silty loess cover, and other areas have loamy sediments over the till. The land surface is generally level to gently rolling and has long slopes. Glacial erratics, occasional pahas (distinctly elongated loess-capped ridges oriented northwest-to-southeast), and outcrops of limestone bedrock are characteristics of the erosion surface in Jones County.

The southern Iowa drift plain is mostly in the northeast and central parts of the county in the Maquoketa River watershed and along various portions of the Wapsipinicon River. The drift plain consists mainly of glacial till covered by deep loess. In many areas adjacent to major streams, however, erosion has removed the deep loess and the glacial till, thus exposing the limestone bedrock in steep bluffs. The land surface is generally characterized by narrow ridges and short, steep side slopes.

The areas that are shallow to bedrock are mainly in the northern half of the county. They also occur as scattered areas along the Wapsipinicon River. Erosion of the surface material in these areas has reduced the soil thickness to less than 5 feet or has exposed the limestone bedrock, creating limitations for farming as well as a severe hazard of ground-water contamination. The land surface in these areas generally is gently sloping to very steep.

The level to nearly level alluvial plains commonly are on narrow to wide flood plains along the rivers and streams. Second bottoms or terraces and loess-covered benches are along the major rivers. The widest areas are along the lower reaches of the Wapsipinicon River and in the Maquoketa River watershed near Monticello.

The North Fork of the Maquoketa River enters the county at Cascade and crosses the northeast corner of the county in a southeasterly direction. The Maquoketa River enters the county 6.5 miles east of the northwest corner and also flows in a southeasterly direction, exiting the county about 9 miles south of the northeast corner. The Wapsipinicon River enters the county 13 miles south of the northwest corner and flows east-southeast, exiting the county in the extreme southeast corner. A small portion of the southwest corner of the county drains into tributaries of the Cedar River. The entire drainage system of the county eventually flows into the Mississippi River.

The highest elevation in the county is 1,090 feet above sea level. It occurs in several areas. The elevation drops to a low of about 704 feet above sea level along the Wapsipinicon River at the southeast corner of the county.

Sinkholes are in scattered areas throughout the county where the soils are somewhat shallow to limestone bedrock. Most are mantled with soil material and are not actively expanding, and a few are shallow enough for cultivation. In some areas the sinkholes are open channels to underground aquifers. In these areas the contamination of ground water is a severe hazard.

Natural Resources

The county has an abundant supply of a variety of natural resources. Among these are limestone, sand, gravel, trees, and water.

Limestone bedrock is at or near the surface in many areas throughout the county. It commonly is crushed and used commercially for road building, concrete, and as a source of lime for crops. Some limestone is quarried for building or landscaping stone.

A few sand and gravel pits are on the stream terraces adjacent to the major rivers and at a few upland sites. The material is used extensively for road surfacing, construction, and concrete aggregate. Many of the extraction sites have been abandoned and have reclamation potential for other uses such as wildlife habitat.

The woodlands, consisting of stands of mixed hardwood and pine, support several small timber harvesting operations and saw mills in the county. The trees and limestone bluffs also have esthetic value.

The abundant water resources in the county provide a high-quality supply for residential and commercial use, as well as for livestock watering. Fishing and boating are available at Central Park Lake as well as on the major rivers. Many canoeists are attracted to the Maquoketa River at Monticello.

Farming

Farming is the main enterprise in Jones County, and a majority of the soils are suited to high-yield production under good management. Farms have been decreasing in number and increasing in size. In 1985, the total number of farms in the county was 1,250 and the average size was 279 acres. The average size in the state was 303 acres in the same year. In 1986, about 69 percent of the farms were owner operated.

Farm production in the county generally consists of mixed livestock and grain crops. Some corn is sold as a cash crop, but the amount sold varies from year to year, depending largely on the price and market for cattle and hogs, the price of corn, and the quality of the crop. Nearly all of the soybeans harvested are sold for cash. The acreage of the main grain crops in Jones County in 1985 was: corn for all purposes, 171,000 acres; soybeans, 42,100 acres; oats, 14,600 acres; and hay, 29,900 acres.

Hogs, beef cattle, and dairy cattle are the common livestock raised in the county. The number of the principal livestock marketed in 1985 was 328,000 hogs, 25,000 grain-fed cattle, and 1,800 grain-fed sheep and lambs. According to the 1985 census, milk cows numbered 5,500.

Transportation Facilities

U.S. Highway 151, running northeast to southwest across the northwest portion of the county, is a major traffic route in northeast Iowa. State Highways 38 and 136 run north-south and intersect U.S. Highway 151 at Monticello and Cascade, respectively. State Highway 64 runs east from Anamosa, and State Highway 1 runs south from Fairview. These routes are connected to all parts of the county by hard surfaced or crushed rock roads. Most farmsteads are on all-weather roads. Scheduled airline transportation is available at Cedar Rapids and Dubuque, both within 50 miles of the county, and a municipal airport is southeast of Monticello. Bus transportation is available at Anamosa, Monticello, and Cascade on U.S. Highway 151. Motor freight lines serve every trading center in the county.

Industry

The county is primarily rural, and farming is the chief industry. Several major manufacturing firms produce a variety of products, including hydraulic equipment, plastics, packaging material, metal buildings, farm equipment, electric motors, and electronic components. Livestock auction markets or buying stations are in several towns.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Anamosa in the period 1951 to 1984. 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 21 degrees F and the average daily minimum temperature is 12 degrees. The lowest temperature on record, which occurred at Anamosa on January 2, 1979, is -29 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred at Anamosa on July 15, 1977, 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 about 34 inches. Of this, 24 inches, or about 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 5.05 inches at Anamosa on July 19, 1963. Thunderstorms occur on about 43 days each year.

The average seasonal snowfall is about 31 inches. The greatest snow depth at any one time during the period of record was 25 inches. On the average, 25 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

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 south. Average windspeed is highest, 13 miles per hour, in spring.

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

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are named and mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

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

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each 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 another but in a different pattern.

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

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

Soil Descriptions

1. Fayette-Downs-Exette Association

Gently sloping to very steep, well drained, silty soils formed in loess; on uplands

This association consists of soils on ridges and convex and concave side slopes. It is dissected by many saucer-shaped drainageways on the upper part of the side slopes. The drainageways grade to narrower, steeper, more distinct drainageways on the lower part of the side slopes. The native vegetation was hardwood timber or mixed hardwood timber and prairie grasses. Slopes range from 2 to 40 percent.

This association makes up about 26 percent of the county. It is about 65 percent Fayette soils, 12 percent Downs soils, 11 percent Exette soils, and 12 percent soils of minor extent (fig. 2).

Fayette soils are on gently sloping to strongly sloping ridges and strongly sloping to very steep side slopes. Downs soils are on gently sloping and moderately sloping ridges and moderately sloping and strongly sloping side slopes. Exette soils are on strongly sloping to steep side slopes.

Typically, the surface layer of the Fayette soils is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable silt loam; the next part is 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 silt loam.

Typically, the surface layer of the Downs soils is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 41 inches thick. The upper part is dark grayish brown, friable silt loam; the next 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 silt loam.

Typically, the surface layer of the Exette soils is brown silt loam about 7 inches thick. It has streaks and pockets of yellowish brown material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is friable silt loam about 22 inches thick. In sequence downward, it is brown, yellowish brown and mottled, mottled light brownish gray and yellowish brown, and light brownish gray and mottled. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam that has large yellowish red accumulations of iron.

Minor in this association are the Arenzville, Chaseburg, Chelsea, Lamont, Lindley, and Orwood soils. The moderately well drained Arenzville and well drained Chaseburg soils are in narrow upland drainageways. The excessively drained Chelsea and well drained Lamont and Orwood soils are on upland ridges and side slopes. The well drained Lindley soils formed in glacial till on narrow ridges and convex nose slopes and side slopes.

The soils in this association are used mainly for cultivated crops. Some areas are pastured or support

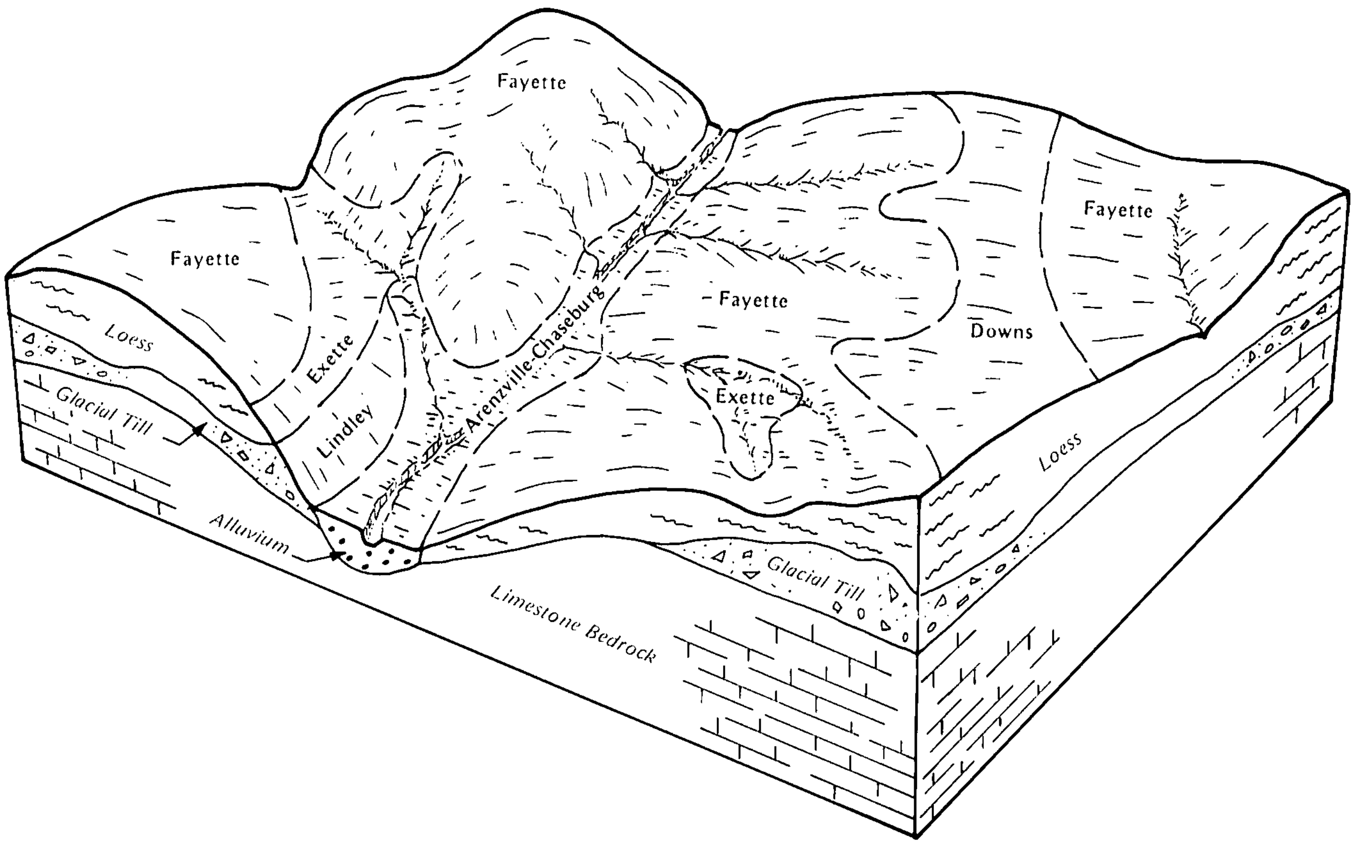

Figure 2.—Typical pattern of soils and parent material in the Fayette-Downs-Exette association.

hardwood timber. The main enterprises are growing corn and soybeans as cash crops and raising and feeding hogs and beef cattle. Most of the soils are well suited to row crops grown in rotation with other crops. The main management concerns are controlling erosion and maintaining tilth and fertility. Contour farming, stripcropping, terraces, and conservation tillage help to prevent excessive soil loss. Some areas are too steep for cultivated crops and should be used for permanent pasture or timber.

2. Dinsdale-Waubeek-Downs Association

Gently sloping to strongly sloping, well drained and moderately well drained, silty soils formed in loess or in loess and the underlying glacial till; on uplands

This association consists of soils on narrow to wide ridgetops and convex side slopes. The side slopes are dissected by many small drainageways. The native vegetation was prairie grasses or mixed hardwood timber and prairie grasses. Slopes range from 2 to 14 percent.

This association makes up about 22 percent of the county. It is about 43 percent Dinsdale and similar soils, 16 percent Waubeek soils, 14 percent Downs soils, and 27 percent minor soils (fig. 3).

Dinsdale soils are well drained and are on gently sloping and moderately sloping, wide ridgetops and narrow, convex side slopes. Waubeek soils are well drained and moderately well drained and are on gently sloping and moderately sloping ridgetops and moderately sloping and strongly sloping, convex side slopes. Downs soils are well drained and are on gently sloping and moderately sloping ridges and moderately sloping and strongly sloping side slopes.

Typically, the surface layer of the Dinsdale soils is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is dark

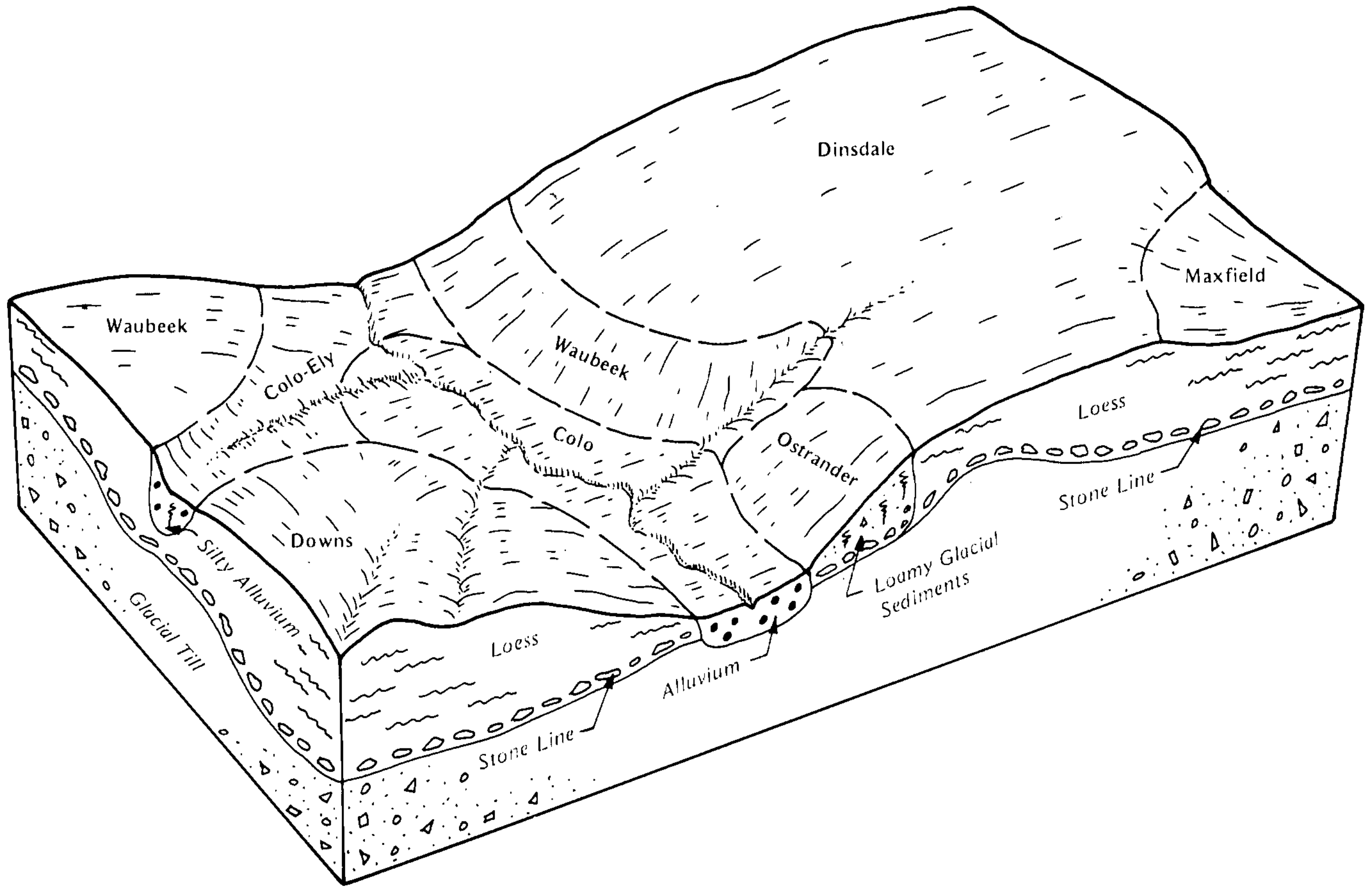

Figure 3.—Typical pattern of soils and parent material in the Dinsdale-Waubeek-Downs association.

brown, brown, and dark yellowish brown, friable silty clay loam; the next part is dark yellowish brown, mottled, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown and light yellowish brown, mottled loam. A stone line commonly separates the loess from the underlying glacial till.

Typically, the surface layer of the Waubeek soils is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is mixed dark grayish brown and dark brown silt loam about 3 inches thick. The subsoil is about 32 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled loam. A stone line commonly separates the loess from the underlying glacial till.

Typically, the surface layer of the Downs soils is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 41 inches thick. The upper part is dark grayish brown, friable silt loam; the next part is dark yellowish brown and 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 silt loam.

Minor in this association are the Colo, Ely, Garwin, Maxfield, and Ostrander soils. The poorly drained Colo and somewhat poorly drained Ely soils are in gently sloping upland drainageways. The poorly drained Garwin and Maxfield soils are in nearly level areas at the head of upland drainageways. The well drained Ostrander soils are in landscape positions similar to those of the Dinsdale and Waubeek soils. They formed in loamy erosional sediments over glacial till.

The soils in this association are used mainly for cultivated crops. Some of the strongly sloping soils are used for permanent pasture or woodland. Most of the trees in areas of this association are in groves or windbreaks near farm buildings. The main enterprises are growing corn and soybeans as cash crops and raising cow-calf herds or hogs. Most of the soils are well suited to row crops. The main management concerns are controlling erosion and maintaining tilth and fertility. A system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, and grassed waterways help to prevent excessive soil loss. In some areas drainage systems may be needed to lower the water table and improve the timeliness of fieldwork.

3. Fayette-Nordness-Rock Outcrop Association

Rock outcrop and moderately sloping to very steep, well drained, silty and loamy soils formed in loess or in loamy or silty material and the underlying residuum over limestone bedrock; on uplands

This association consists of soils on narrow ridges and strongly dissected, convex side slopes. It typically has narrow, meandering stream valleys bordered by very steep side slopes that have scattered limestone outcrops. Along major streams and their tributaries, limestone bluffs or escarpments rise abruptly 25 to 200 feet in height above the narrow bottom land. The native vegetation was hardwood timber. Slopes range from 5 to 60 percent.

This association makes up about 19 percent of the county. It is about 60 percent Fayette soils, 22 percent Nordness and similar soils and Rock outcrop, and 18 percent minor soils (fig. 4).

Fayette soils formed in loess. They are on moderately sloping and strongly sloping ridges and moderately steep to very steep side slopes. Nordness soils formed in loamy or silty sediments and in the underlying limestone bedrock residuum. They are on moderately sloping and strongly sloping ridges and strongly sloping to very steep side slopes. The Rock outcrop is exposed limestone bedrock. It is on very steep upland slopes and escarpments.

Typically, the surface layer of the Fayette soils is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Typically, the surface layer of the Nordness soils is very dark grayish brown loam about 2 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is about 9 inches thick. The upper part is mixed brown and very dark grayish brown, friable loam, and the lower part is brown and reddish brown, friable silty clay loam. Level-bedded, fragmented limestone bedrock is at a depth of about 14 inches.

In some areas the Rock outcrop has a thin layer of loam or silt loam overlying the bedrock. In other areas limestone fragments cover much of the surface.

Minor in this association are the Arenzville, Backbone, Chaseburg, Dubuque, and Winneshiek soils. The moderately well drained Arenzville and well drained Chaseburg soils are in narrow upland drainageways and on bottom land. The well drained Backbone soils are on convex ridges and side slopes. The well drained Dubuque and Winneshiek soils are on ridges and side slopes in the uplands. The Backbone, Dubuque, and Winneshiek soils commonly are 20 to 40 inches deep over limestone bedrock.

Most of the soils in this association are used for pasture or hayland or are managed as woodland. The larger areas of Nordness soils support trees. Raising dairy cows, beef cattle, or hogs is the major farm enterprise. In the less sloping areas on ridges and bottom land, corn is grown in rotation with oats and hay. Most of the grain is fed to the livestock. The less sloping areas of Fayette soils are moderately well suited to row crops. The moderately steep to very steep soils are poorly suited or unsuited to cultivated crops because of the slope and the depth to limestone bedrock. The main management concerns are controlling erosion and maintaining tilth and fertility. Contour farming, stripcropping, terraces, conservation tillage, crop rotations, or a combination of these can help to prevent excessive soil loss. The contamination of ground water is a hazard because of the shallowness to fractured limestone bedrock and the scattered sinkholes. Special precautions may be necessary to reduce the risk of pollution of ground water. These areas are best suited to pasture, woodland, or wildlife habitat.

4. Ostrander-Floyd-Clyde Association

Nearly level to moderately sloping, well drained, somewhat poorly drained, and poorly drained, loamy and silty soils formed in loamy sediments and the underlying glacial till; on uplands

This association consists of soils on long, wide, convex ridgetops and side slopes; on lower, concave

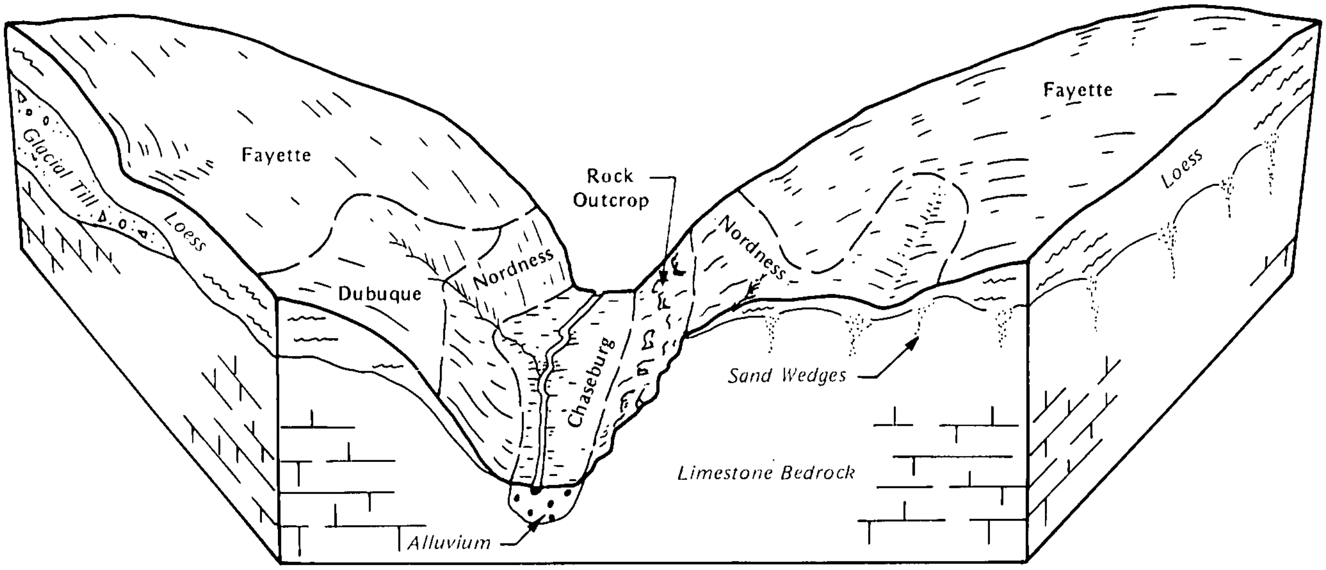

Figure 4.—Typical pattern of soils and parent material in the Fayette-Nordness-Rock outcrop association.

foot slopes; and in drainageways. Relief is generally low. The network of drainageways form an integrated dendritic pattern. Glacially deposited, granite boulders and stones were once common on the surface, but most were removed as the soils were cultivated. The soils formed mainly in glacial outwash or erosional sediments and the underlying glacial till. The native vegetation was prairie grasses. Slopes range from 0 to 9 percent.

This association makes up about 12 percent of the county. It is 45 percent Ostrander and similar soils, 21 percent Floyd soils, 20 percent Clyde soils, and 14 percent minor soils (fig. 5).

Ostrander soils are well drained and are on gently sloping and moderately sloping, long, convex ridgetops and side slopes. Floyd soils are somewhat poorly drained and are on very gently sloping, concave foot slopes and lower side slopes along upland drainageways. Clyde soils are poorly drained and are in nearly level drainageways and on lower, concave foot slopes.

Typically, the surface layer of the Ostrander soils is black loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown loam about 11 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, friable loam; the next part is yellowish brown, mottled, friable sandy clay loam; and the lower part is yellowish brown, mottled, firm sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled loam.

Typically, the surface layer of the Floyd soils is black loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown loam about 16 inches thick. The subsoil is about 25 inches thick. In sequence downward, it is dark grayish brown, mottled, friable loam; mottled grayish brown and yellowish brown, friable sandy clay loam; olive brown, mottled, very friable sandy loam; and mottled light brownish gray and strong brown, firm loam. The substratum to a depth of about 60 inches is mottled light brownish gray and strong brown loam.

Typically, the surface layer of the Clyde soils is black silty clay loam about 7 inches thick. The subsurface layer is black and very dark gray silty clay loam about 10 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam; the next part is light brownish gray, mottled, friable loam; and the lower part is mottled light brownish gray and yellowish brown, firm loam. The substratum to a depth of about 60 inches is mottled gray and strong brown loam.

Minor in this association are the Bolan, Dickinson, Dinsdale, Olin, and Sparta soils. The well drained Bolan and somewhat excessively drained Dickinson soils are on gently sloping and moderately sloping ridges and side slopes. The lower part of the subsoil and the substratum of the Bolan and Dickinson soils formed in sandy sediments. The well drained Dinsdale soils are on gently sloping and moderately sloping ridges and side slopes. They formed in loess and the underlying

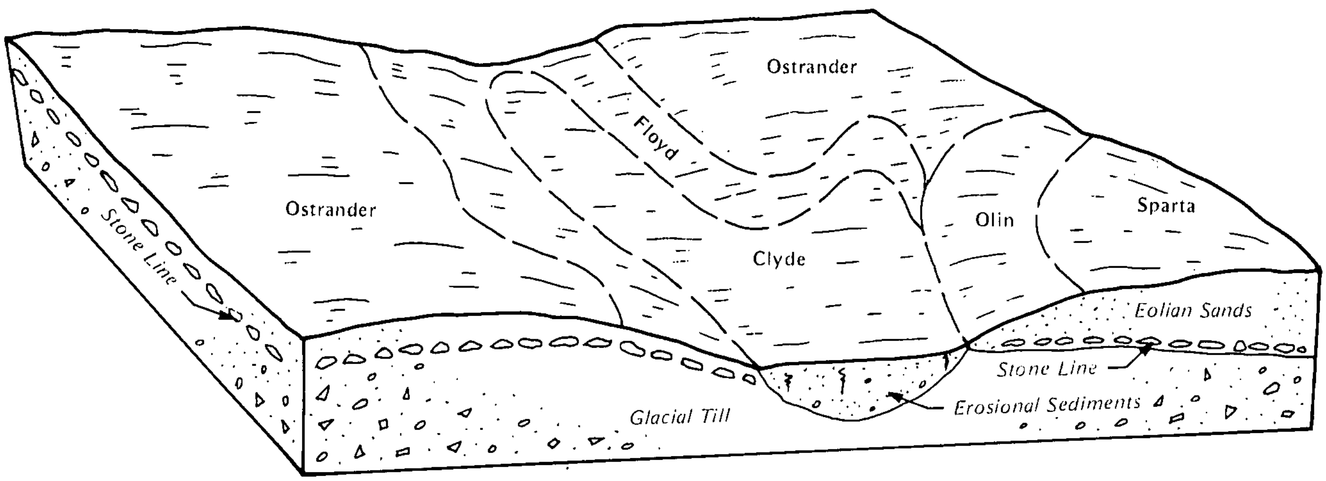

Figure 5.—Typical pattern of soils and parent material in the Ostrander-Floyd-Clyde association.

glacial till. The well drained Olin soils are on gently sloping and moderately sloping ridges and side slopes. They formed in sandy eolian material and the underlying glacial till. The excessively drained Sparta soils are on dune-shaped, narrow ridges and side slopes. They formed in sandy eolian material.

The soils in this association are used mainly for cultivated crops. A few areas are used for permanent pasture, mainly in areas of the Floyd and Clyde soils that have not been drained. The main enterprises are growing corn and soybeans as cash crops and feeding hogs and cow-calf herds. The soils are well suited or moderately well suited to intensive row cropping. The main management concerns are controlling erosion, improving drainage, and maintaining tilth and fertility. A system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, and grassed waterways help to prevent excessive soil loss. Subsurface tile drains help to remove excess moisture and improve the timeliness of fieldwork. A combination of terraces and drainage tile generally is most effective.

5. Sawmill-Chaseburg-Perks Association

Nearly level, poorly drained, well drained, and excessively drained, silty and loamy soils formed in alluvial sediments; on bottom land

This association consists of soils on narrow to wide flood plains in the major stream valleys. Abandoned stream channels are common in some areas. The native vegetation was prairie grasses or deciduous trees. Because of frequent flooding on the Chaseburg and Perks soils and the resulting deposition of new material, some areas of these soils show little evidence of profile development. Slopes range from 0 to 2 percent.

This association makes up about 10 percent of the county. It is about 30 percent Sawmill and similar soils, 25 percent Chaseburg soils, 20 percent Perks soils, and 25 percent minor soils.

Sawmill soils are poorly drained and are on moderately wide or wide bottom land along tributaries of the major rivers. They commonly are adjacent to upland slopes. Chaseburg soils are well drained and are on narrow to wide bottom land. They commonly are adjacent to the stream channels. Perks soils are excessively drained and are on moderately wide or wide bottom land along the major streams. They commonly are adjacent to the stream channels.

Typically, the surface layer of the Sawmill soils is very dark gray silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 14 inches thick. Below this is a transitional layer of very dark gray, friable silty clay loam about 10 inches thick. The subsoil is mottled, friable silty clay loam about 18 inches thick. The upper part is dark gray, the next part is olive gray, and the lower part is light gray. The substratum to a depth of about 60 inches is mottled olive gray, yellowish red, and strong brown silt loam.

Typically, the surface layer of the Chaseburg soils is dark grayish brown silt loam about 10 inches thick. The substratum to a depth of about 60 inches is multicolored, stratified silt loam.

Typically, the surface layer of the Perks soils is very dark grayish brown sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand.

Minor in this association are the Arenzville, Colo, Marshan, Ossian, and Waukee soils. The moderately well drained Arenzville soils are on narrow or moderately wide bottom land. They are underlain by a black buried soil. The poorly drained Colo and Ossian soils are on moderately wide bottom land. The poorly drained Marshan soils are on narrow to wide bottom land. They have sand and gravel at a depth of 32 to 40 inches. The well drained, nearly level to gently sloping Waukee soils are on alluvial terraces.

The soils in this association are used mainly for cultivated crops. A few areas are used for permanent pasture. These are mainly areas of old meander channels or sand and gravel deposits adjacent to the stream channels. The main enterprises are growing corn and soybeans as cash crops and feeding hogs and cow-calf herds. Some areas along the stream channels are wooded. The trees in these areas are typically not of sufficient quality for commercial wood production.

In most areas of this association, the soils are well suited or moderately well suited to intensive row cropping. The main management concerns are drainage, flooding, and droughtiness. The Sawmill soils should be drained where suitable outlets are available. The Chaseburg and Perks soils should be protected from flooding. A conservation tillage system that leaves crop residue on the surface helps to prevent excessive moisture loss through evaporation, particularly during periods when rainfall is below normal.

6. Chelsea-Orwood-Sparta Association

Very gently sloping to very steep, excessively drained and well drained, sandy and silty soils formed in eolian sediments; on uplands and stream terraces

This association consists of soils on undulating and dunelike landscapes. The soils in the uplands are on moderately sloping and strongly sloping, narrow ridgetops and strongly sloping to very steep side slopes. The soils on stream terraces are on broad to narrow ridges and strongly sloping to steep, narrow side slopes. The native vegetation was hardwood timber, mixed hardwood timber and prairie grasses, or prairie grasses. Slope ranges from 1 to 30 percent.

This association makes up about 6 percent of the county. It is about 25 percent Chelsea soils, 20 percent Orwood and similar soils, 15 percent Sparta soils, and 40 percent soils of minor extent.

Chelsea soils are excessively drained and are on moderately sloping and strongly sloping ridgetops and strongly sloping to very steep side slopes on uplands and high stream terraces near major streams. Orwood soils are well drained and are on moderately sloping and strongly sloping ridgetops and strongly sloping to steep side slopes in the uplands. Sparta soils are excessively drained and are on very gently sloping to moderately sloping, wide to very narrow ridges and side slopes on uplands and stream terraces.

Typically, the surface layer of the Chelsea soils is very dark gray loamy fine sand about 3 inches thick. The subsurface layer is about 28 inches thick. The upper part is dark grayish brown fine sand, and the lower part is brown and yellowish brown fine sand. Below this to a depth of about 60 inches is pale brown, loose, fine sand that has bands of brown sandy loam ¼ inch to 2 inches thick.

Typically, the surface layer of the Orwood soils is very dark grayish brown silt loam that is high in sand content. It is about 7 inches thick. The subsoil is about 47 inches thick. The upper part is brown and dark yellowish brown, friable silt loam; the next part is dark yellowish brown and yellowish brown, friable loam; and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. Typically, the surface layer of the Sparta soils is very dark brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown and dark brown loamy fine sand about 9 inches thick. The subsoil is about 13 inches thick. The upper part is brown, very friable loamy fine sand, and the lower part is dark yellowish brown, very friable fine sand. Below this to a depth of about 60 inches is yellowish brown fine sand.

Minor in this association are the Bolan, Dickinson, Lamont, and Ostrander soils. The well drained Bolan and somewhat excessively drained Dickinson soils are on gently sloping and moderately sloping ridges and side slopes. The well drained Lamont soils are on gently sloping and moderately sloping ridges and moderately sloping to moderately steep side slopes. The well drained Ostrander soils are on gently sloping and moderately sloping ridges and side slopes in the uplands. Ostrander soils formed in loamy erosional sediments and in the underlying glacial till.

Many areas of these soils are not suitable for cultivation and generally are used for pasture, hayland, or woodland. Some areas on ridgetops and stream terraces, however, are used for cultivated crops. The soils in this association tend to be droughty and susceptible to wind and water erosion. The Orwood soils are moderately well suited to row cropping, but the

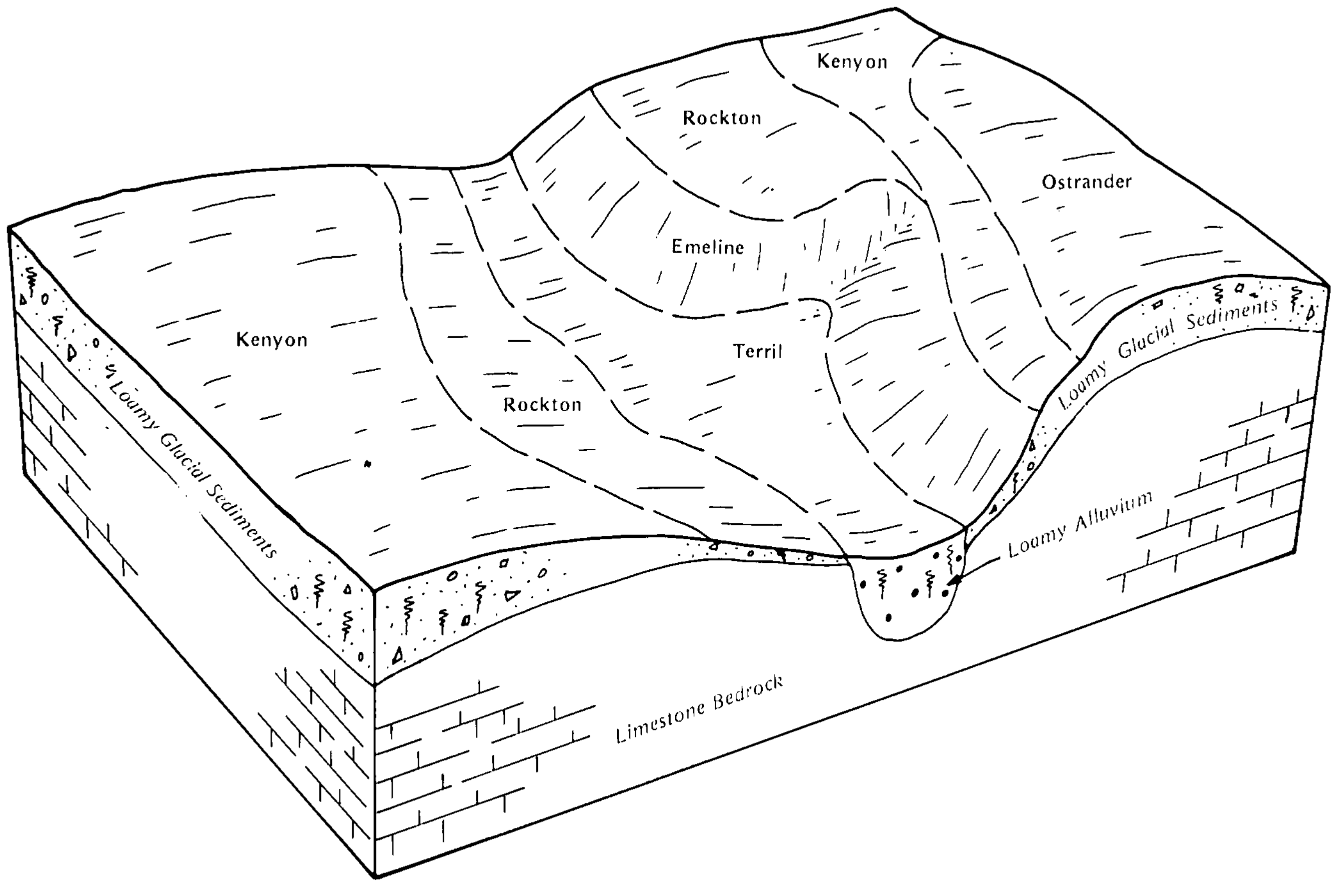

Figure 6.—Typical pattern of soils and parent material in the Kenyon-Rockton-Emeline association.

Chelsea and Sparta soils are poorly suited. The main management concerns are reducing droughtiness, controlling erosion, and maintaining tilth and fertility. A system of conservation tillage that leaves crop residue on the surface conserves soil moisture, helps to prevent excessive soil loss, and improves or maintains tilth. If properly managed, most areas are best suited to permanent pasture, woodland, or wildlife habitat.

7. Kenyon-Rockton-Emeline Association

Gently sloping to moderately steep, somewhat excessively drained to moderately well drained, loamy soils formed in loamy sediments and the underlying glacial till or in residuum over limestone bedrock; on uplands

This association consists of shallow to moderately deep soils on narrow to wide ridges and convex side slopes. Relief is generally low. The association is characterized by a poorly developed network of drainageways. The drainageways commonly change direction at right angles, following crevices in the limestone bedrock. The native vegetation was prairie grasses. Slopes range from 2 to 18 percent.

This association makes up about 5 percent of the county. It is about 33 percent Kenyon soils, 17 percent Rockton soils, 11 percent Emeline soils, and 39 percent minor soils (fig. 6).

Kenyon soils are moderately well drained and are on broad, gently sloping and moderately sloping ridgetops and convex side slopes. They formed in loamy sediments and the underlying glacial till. Rockton soils are well drained and are on broad, gently sloping ridgetops and narrow, moderately sloping side slopes. They formed in 20 to 40 inches of loamy sediments and the underlying limestone bedrock residuum. Emeline soils are somewhat excessively drained and are on gently sloping and moderately sloping ridges and short, strongly sloping and moderately steep side slopes. They formed in 4 to 12 inches of loamy sediments overlying limestone bedrock. Outcrops of limestone bedrock are common, particularly on the steeper slopes.

Typically, the surface layer of the Kenyon soils is black loam about 9 inches thick. The subsurface layer is black loam about 5 inches thick. The subsoil is about 37 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown, mottled, friable loam; and the lower part is mottled, yellowish brown, strong brown, light olive brown, and light brownish gray, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown, light brownish gray, and strong brown sandy clay loam.

Typically, the surface layer of the Rockton soils is very dark brown loam about 10 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 17 inches thick. It is friable. The upper part is brown loam, and the lower part is dark yellowish brown clay loam. Hard, fractured limestone bedrock is at a depth of about 32 inches.

Typically, the surface layer of the Emeline soils is black loam about 9 inches thick. Level-bedded, hard, fragmented limestone bedrock is at a depth of about 9 inches.

Minor in this association are the Bertram, Ostrander, Ripon, and Terril soils. The somewhat excessively drained Bertram soils are on gently sloping and moderately sloping ridges and side slopes. They formed in sandy sediments and the underlying limestone residuum. The well drained Ostrander and Ripon soils are on gently sloping and moderately sloping ridges and side slopes. The well drained Terril soils are on gently sloping and moderately sloping, concave foot slopes and convex alluvial fans. They formed in loamy alluvium.

The soils in this association are used mainly for cultivated crops. Some areas are used for permanent pasture or woodland, particularly those areas that are shallow to limestone bedrock. The main enterprises are growing corn and soybeans as cash crops and feeding hogs and cow-calf herds. The Kenyon and Rockton soils are well suited to row cropping. The Emeline soils are unsuited to cultivated crops. They are best suited to pasture, woodland, or wildlife habitat. The main management concerns are controlling erosion and maintaining tilth and fertility. A system of conservation tillage that leaves crop residue on the surface and contour farming help to prevent excessive soil loss. The Emeline soils may be droughty. The Kenyon soils are suitable for terracing.

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 substratum, 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 substratum. 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, Downs silt loam, benches, 2 to 5 percent slopes, is a phase of the Downs 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, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Arenzville-Chaseburg silt loams, 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. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Pits, sand and gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown 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.

Soil Descriptions

8B—Judson silt loam, 1 to 5 percent slopes. This very gently sloping and gently sloping, well drained soil is on slightly concave foot slopes and alluvial fans. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is silty clay loam about 26 inches thick. The upper part is very dark brown, and the lower part is very dark grayish brown. The subsoil to a depth of about 60 inches is friable silty clay loam. The upper part is dark brown, the next part is dark yellowish brown, and the lower part is brown and has pale brown and yellowish brown mottles. In some areas the soil is silt loam to a depth of about 30 inches.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

8C—Judson silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on slightly concave or smooth foot slopes and alluvial fans. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is silty clay loam about 22 inches thick. The upper part is very dark brown, and the lower part is very dark grayish brown. The subsoil to a depth of about 60 inches is friable silty clay loam. The upper part is dark brown, the next part is dark yellowish brown, and the lower part is brown and has pale brown and yellowish brown mottles. In some areas the soil is silt loam to a depth of about 30 inches.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

11B—Colo-Ely silty clay loams, 2 to 5 percent slopes. These gently sloping soils are in drainageways on uplands. The poorly drained Colo soil is near or within the stream channels or waterways. It is occasionally flooded. The somewhat poorly drained Ely soil occurs as narrow bands between the stream channels and the nearby side slopes. Individual areas are long and narrow or irregular in shape and range from 5 to 30 acres in size. They are about 60 percent Colo soil and 30 percent Ely soil. The two soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Colo soil has a surface layer of black silty clay loam about 9 inches thick. The subsurface layer also is black silty clay loam. It is about 30 inches thick. The subsoil is very dark gray silty clay loam about 10 inches thick. The substratum to a depth of about 60 inches is dark gray, light olive gray, and light brownish gray, mottled silty clay loam.

Typically, the Ely soil has a surface layer of black silty clay loam about 8 inches thick. The subsurface layer also is black silty clay loam. It is about 11 inches thick. Below this is a transitional layer of very dark gray silty clay loam about 7 inches thick. The subsoil is friable silty clay loam about 25 inches thick. The upper part is grayish brown and mottled, the next part is brown and mottled, and the lower part is mottled brown and light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam. In places the subsoil is dark brown and brown silty clay loam.

Included with these soils in mapping are some small areas of the well drained Judson soils directly adjacent to the upland side slopes. These included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Colo soil. Surface runoff is slow. Available water capacity is high. This soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 5 to 7 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Permeability is moderate in the Ely soil. Surface runoff is medium. Available water capacity is high. This soil has a seasonal high water table at a depth of 2 to 4 feet. The content of organic matter is about 5 to 6 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

In most areas these soils are used for cultivated crops or hay. They are well suited to corn, soybeans, and small grain and to grasses for hay and pasture. They generally are wet because of overflow and seepage from the more sloping adjacent soils. In drainageways that carry a high concentration of water, a good cover of grasses is needed to prevent gullying. Properly installed subsurface drains generally are needed to remove excess water in drainageways. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility and helps to maintain good tilth.

If these soils are used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soils are too wet causes surface compaction, increased runoff, and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIw.

27B—Terril loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on slightly concave foot slopes and convex alluvial fans. Slopes generally are short. Individual areas are irregular in shape or are long and narrow. They range from 5 to 25 acres in size.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark grayish brown loam about 23 inches thick. The subsoil to a depth of 60 inches or more is friable loam. The upper part is dark brown and brown, and the lower part is dark yellowish brown and mottled. In places the upper part of the subsoil is very dark grayish brown.

Included with this soil in mapping are small areas of soils that have limestone bedrock within a depth of 40 inches. These soils are in positions on the landscape similar to those of the Terril soil. They make up about 5 percent of the unit.

Permeability is moderate in the Terril soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Farming on the contour and terracing are difficult in places because slopes are short and irregular. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

27C—Terril loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on slightly concave foot slopes. Individual areas are commonly long and narrow and range from 5 to 10 acres in size.

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer is black and very dark grayish brown loam about 23 inches thick. The subsoil to a depth of 60 inches or more is friable loam. The upper part is dark brown and brown, and the lower part is dark yellowish brown and mottled.

Included with this soil in mapping are small areas of soils that have limestone bedrock within a depth of 40 inches. These soils are in positions on the landscape similar to those of the Terril soil. They make up about 10 percent of the unit.

Permeability is moderate in the Terril soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. A few are used for pasture. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface, contour farming, or terraces or by a combination of these. The soil receives runoff from the adjacent uplands. Diversion terraces help to control the runoff and thus help to prevent the crop damage caused by the deposition of sediments. Good tilth generally can be easily maintained.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

41B—Sparta loamy fine sand, 1 to 5 percent slopes. This very gently sloping and gently sloping, excessively drained soil is on convex upland slopes and stream terraces. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark brown loamy fine sand about 8 inches thick. The subsurface layer is very dark grayish brown and dark brown loamy fine sand about 9 inches thick. The subsoil is about 13 inches thick. The upper part is brown, very friable loamy fine sand, and the lower part is dark yellowish brown, very friable fine sand. Below this to a depth of about 60 inches is yellowish brown fine sand. In some places the surface layer is very dark grayish brown or dark brown, friable fine sandy loam. In other places the surface soil is less than 10 inches thick.

Permeability is rapid. Surface runoff is slow. Available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or used for pasture. This soil is poorly suited to corn, soybeans, and small grain, mainly because it is droughty and low in fertility. If cultivated crops are grown, wind erosion and water erosion are hazards. Windblown sand grains can damage seedlings on this soil and on the adjacent soils. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is generally unsuitable for terracing. Tilth generally is poor in the surface layer because the content of organic matter is moderately low and the soil structure breaks down easily. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility.

A cover of pasture plants or hay is effective in controlling erosion. Managing pasture is difficult, however, on this droughty soil. Permanent pasture can be improved by renovating and reseeding. Once the permanent pasture is established, proper stocking rates, rotation grazing, deferment of grazing during dry periods, and restricted use during wet periods help to keep the pasture in good condition.

Only a few areas are used as woodland. This soil is moderately well suited to trees. Seedling mortality is severe. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Supplemental water may be needed because the soil is droughty. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling.

The land capability classification is IVs.

41C—Sparta loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil generally is on stream terraces and in upland areas that commonly are adjacent to drainageways. In a few areas it is on dunelike ridges oriented from northwest to southeast. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 10 inches thick. The subsurface layer is dark brown loamy fine sand about 5 inches thick. The subsoil is about 13 inches thick. It is brown, very friable loamy fine sand in the upper part and dark yellowish brown, very friable fine sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown fine sand. In places it is loam glacial till.

Included with this soil in mapping are areas of gravelly loamy sand and gravelly sandy loam. These soils are in positions on the landscape similar to those of the Sparta soil. They are lower in organic matter content than the Sparta soil and have a lower available water capacity. They make up less than 5 percent of the unit. Also included are small areas of short slopes that are more than 9 percent.

Permeability is rapid in the Sparta soil. Surface runoff is medium. Available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are used for pasture. A few small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil generally is unsuitable for cultivated crops, but it is suited to grasses and legumes for hay and pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, wind erosion and water erosion are severe hazards. A permanent plant cover helps to prevent excessive soil loss. Tilth generally is poor in the surface layer because the content of organic matter is moderately low and the soil structure breaks down easily.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

This soil is moderately well suited to trees. It supports trees in groves and around farmsteads, but few areas are extensively wooded. Seedling mortality is severe. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Supplemental water may be needed because the soil is droughty. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling.

The land capability classification is VIs.

42—Granby fine sandy loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in depressions in outwash areas and on stream terraces. Individual areas are irregular in shape and are 2 to 5 acres in size.

Typically, the surface layer is black fine sandy loam about 10 inches thick. The subsoil is sand about 40 inches thick. The upper part is dark grayish brown and dark gray and is very friable; the next part is grayish brown and yellowish brown, mottled, and very friable; and the lower part is mottled dark grayish brown, light olive brown, dark gray, and light brownish gray. The substratum to a depth of about 60 inches is gray, mottled sand. In places the surface layer is thinner.

Included with this soil in mapping are small areas of the somewhat poorly drained Brady soils. These soils typically are more productive than the Granby soil and have a lower seasonal high water table. They make up about 5 percent of the unit.

Permeability is rapid in the Granby soil. Surface runoff is slow or very slow, and water ponds in some of the depressions for brief periods. Available water capacity is low. The seasonal high water table is within a depth of 1 foot. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are used for cultivated crops, hay, or pasture. A few areas support water-tolerant grasses. This soil is poorly suited to corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. Subsurface drains cannot be easily installed and maintained because of the underlying loose sand and a lack of adequate outlets. As the water table drops late in the growing season, the soil can become droughty if rainfall is below normal. If used for cultivated crops, the soil is subject to wind erosion. A system of conservation tillage that leaves crop residue on the surface or regular additions of other organic material can help to prevent excessive soil loss and improve fertility. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay is effective in controlling wind erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. Tree seeds, cuttings, and seedlings cannot easily survive and grow well because of the seasonal high water table. Competing vegetation should be controlled or removed by proper site preparation, prescribed burning, or spraying, cutting, or girdling.

The land capability classification is IVw.

63B—Chelsea loamy fine sand, 2 to 5 percent slopes. This gently sloping, excessively drained soil generally is on convex, dunelike, low ridges and convex side slopes in the uplands. It also is in isolated areas on high stream benches. Individual areas are irregularly shaped or round and range from 2 to more than 15 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 3 inches thick. The subsurface layer is fine sand about 28 inches thick. The upper part is dark grayish brown, and the lower part is brown and yellowish brown. Below this to a depth of about 60 inches is pale brown, loose fine sand that has bands of brown sandy loam ¼ inch to 2 inches thick. In places the bottom layer is loam glacial till.

Included with this soil in mapping are small areas of the well drained Lamont soils. These soils are in positions on the landscape similar to those of the Chelsea soil. They have a higher available water capacity than the Chelsea soil. They make up less than 5 percent of the unit.

Permeability is rapid in the Chelsea soil. Surface runoff is slow. Available water capacity is low. The content of organic matter is 0.5 to 1.5 percent in the surface layer. The subsurface layer generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are used for pasture or support hardwood timber. A few small areas are cultivated along with larger areas of adjacent soils that are better suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, wind erosion is a hazard.

Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth. Tilth generally is poor in the surface layer because the soil has a low content of organic matter and the soil structure breaks down easily. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

This soil is moderately suited to trees. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. No other major hazards or limitations affect planting or harvesting.

The land capability classification is IVs.

63C—Chelsea loamy fine sand, 5 to 9 percent slopes. This moderately sloping, excessively drained soil generally is on dunelike ridges and convex side slopes in upland areas that generally are adjacent to stream valleys. It also is in isolated areas on high stream benches. Individual areas are irregularly shaped or round and range from 3 to 20 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 3 inches thick. The subsurface layer is fine sand about 28 inches thick. The upper part is dark grayish brown, and the lower part is brown and yellowish brown. Below this to a depth of about 60 inches is pale brown, loose fine sand that has bands of brown sandy loam ¼ inch to 2 inches thick. In places the bottom layer is loam glacial till.

Included with this soil in mapping are small areas of the well drained Lamont soils. These soils are in positions on the landscape similar to those of the Chelsea soil. They have a higher available water capacity than the Chelsea soil. They make up less than 5 percent of the unit.

Permeability is rapid in the Chelsea soil. Surface runoff is medium. Available water capacity is low. The content of organic matter is 0.5 to 1.5 percent in the surface layer. The subsurface layer generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are used for pasture or support hardwood timber. A few small areas are cultivated along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. Droughtiness is a severe limitation in most years unless rainfall is timely. If cultivated crops are grown, wind erosion is a hazard. Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. The soil warms up quickly in the spring, thus stimulating early plant growth, particularly on south- and east-facing slopes. Tilth generally is poor in the surface layer because the soil has a low content of organic matter and the soil structure breaks down easily.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

This soil is moderately suited to trees. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. No other major hazards or limitations affect planting or harvesting.

The land capability classification is IVs.

63F—Chelsea loamy fine sand, 9 to 30 percent slopes. This strongly sloping to very steep, excessively drained soil is on convex slopes in the uplands and on escarpments on stream benches. Individual areas are irregularly shaped and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is about 20 inches of dark grayish brown, brown, and yellowish brown loamy fine sand and fine sand. Below this to a depth of about 60 inches is yellowish brown and light yellowish brown, loose fine sand that has many bands of brown sandy loam. In places the surface layer is brown or dark brown loamy fine sand.

Included with this soil in mapping are small areas of the well drained Lamont soils. These soils are in landscape positions similar to those of the Chelsea soil. They have a slightly higher available water capacity than the Chelsea soil. They make up less than 5 percent of the unit.

Permeability is rapid in the Chelsea soil. Surface runoff also is rapid. Available water capacity is low. The content of organic matter is 0.5 to 1.5 percent in the surface layer. The subsurface layer generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas support hardwood timber. A few are used for pasture. This soil is generally unsuited to cultivated crops and is poorly suited to hay and pasture, mainly because it is droughty and is low in fertility. It is subject to wind erosion. As a result, a permanent plant cover is needed. Tilth generally is poor in the surface layer because the soil has a low content of organic matter and the soil structure breaks down easily.

A cover of pasture plants may be effective in controlling erosion. Proper stocking rates, rotation grazing, and timely deferment of grazing, especially during dry periods, help to keep the pasture in fairly good condition. Renovating pastures is difficult because slopes are too steep for the use of ordinary farm machinery.

Many areas support native hardwoods. This soil is moderately suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on the contour reduce the hazard of erosion. Because of the slope, operating equipment is somewhat hazardous. Special equipment and caution in operating the equipment are needed. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is VIIs.

65C2—Lindley loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridgetops and on convex nose slopes and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. It has streaks and pockets of dark yellowish brown subsoil material. The subsoil is about 41 inches thick. The upper part is dark yellowish brown, friable loam; the next part is yellowish brown, friable clay loam; and the lower part is yellowish brown, mottled, friable and firm clay loam. The substratum to a depth of about 60 inches is mottled grayish brown, light brownish gray, yellowish brown, and strong brown loam. In some places the surface layer is thinner and is brown and yellowish brown. In other places it is silt loam.

Permeability is moderately slow. Surface runoff is rapid. Available water capacity is moderate or high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for permanent pasture or cultivated crops. This soil is moderately well suited to corn and soybeans. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Growing row crops in rotation with oats, hay, and pasture also helps to control erosion. The soil is low in fertility and has a highly dense subsoil. Revegetating is difficult if the subsoil is exposed. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few areas support hardwood timber. This soil is moderately well suited to trees. Laying out logging trails and roads on or nearly on the contour helps to control erosion. Seedling mortality and plant competition are slight.

The land capability classification is IIIe.

65E2—Lindley loam, 9 to 18 percent slopes, moderately eroded. This strongly sloping and moderately steep, well drained soil is on convex nose slopes and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. It has streaks and pockets of dark yellowish brown loam from the subsoil. The subsoil is about 40 inches thick. The upper part is dark yellowish brown, friable loam; the next part is yellowish brown, friable clay loam; and the lower part is yellowish brown, mottled, friable and firm clay loam. The substratum to a depth of about 60 inches is mottled grayish brown, light brownish gray, yellowish brown, and strong brown clay loam. In some seepy areas the subsoil is reddish brown or yellowish red and contains more clay. In places the surface layer is silt loam.

Permeability is moderately slow. Surface runoff is rapid. Available water capacity is moderate or high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture and hay. They may have been cultivated at some time in the past. This soil generally is unsuitable for cultivated crops because of the slope and a severe hazard of erosion. It is better suited to grasses and legumes for hay and pasture. Tilth generally is poor in the surface layer.

A cover of pasture plants or hay is effective in controlling erosion. Reseeding or pasture renovation is needed in some of the steeper areas. Preparing a seedbed may be difficult because of the slope, and operating farm machinery may be difficult and dangerous. Overgrazing or grazing when the soil is too wet causes surface compaction and deterioration of tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few areas support hardwood timber. This soil is moderately suited to trees. Erosion, the equipment limitation, and seedling mortality are the main management concerns. Carefully selecting sites for logging trails and roads and laying out the trails and roads on the contour help to control erosion. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is VIe.

65F2—Lindley loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on short, convex side slopes and nose slopes in the uplands. Individual areas are commonly elongated and range from 2 to 10 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. It has streaks and pockets of dark yellowish brown subsoil material. The subsoil is about 39 inches thick. The upper part is dark yellowish brown, friable loam; the next part is yellowish brown, friable clay loam; and the lower part is yellowish brown, mottled, friable and firm clay loam. The substratum to a depth of about 60 inches is mottled grayish brown, light brownish gray, yellowish brown, and strong brown clay loam. In places the surface layer is brown and yellowish brown.

Included with this soil in mapping are small areas of reddish clay or sand on the higher parts of the side slopes. Water commonly seeps from these areas during extended wet periods. Included areas make up about 10 percent of the unit.

Permeability is moderately slow in the Lindley soil. Surface runoff is rapid or very rapid. Available water capacity is moderate or high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Although some areas were previously cultivated, most areas are used for permanent pasture. This soil generally is unsuitable for cultivated crops because further erosion is a severe hazard and in some areas slopes are too steep for the use of ordinary farm machinery. Tilth generally is poor in the surface layer.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few areas support hardwood timber. This soil is moderately well suited to trees. Seedling mortality, the equipment limitation, and the hazard of erosion are moderate. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, special logging equipment is needed. A large number of seedlings should be planted at close intervals because the survival rate is limited. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is VIIe.

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

Typically, the surface layer is black loam about 9 inches thick. The subsurface layer also is black loam. It is about 5 inches thick. The subsoil is about 37 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown, mottled, friable loam; and the lower part is mottled yellowish brown, grayish brown, and strong brown, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown, light brownish gray, and strong brown sandy clay loam. In places the surface soil is thinner and has a lower content of organic matter.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd soils. These soils are along upland drainageways. Fieldwork is delayed in some areas unless the Floyd soils are drained. These soils make up less than 10 percent of the unit.

Permeability is moderate in the Kenyon soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

83C—Kenyon loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on short, convex side slopes in the uplands. Individual areas are commonly somewhat narrow, irregularly shaped bands and range from 2 to 10 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 5 inches thick. The subsoil is loam about 37 inches thick. The upper part is brown and dark yellowish brown and is friable; the next part is yellowish brown, mottled, and friable; and the lower part is mottled yellowish brown, grayish brown, and strong brown and is firm. The substratum to a depth of about 60 inches is mottled yellowish brown, light brownish gray, and strong brown sandy clay loam. In places the surface soil is thinner and has a lower content of organic matter.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately well suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

83C2—Kenyon loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes in the uplands. Individual areas are commonly somewhat narrow, irregularly shaped bands and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown loam about 7 inches thick. It has streaks and pockets of brown and dark yellowish brown subsoil material. The subsoil is loam about 35 inches thick. The upper part is brown and dark yellowish brown and is friable; the next part is yellowish brown, mottled, and friable; and the lower part is mottled yellowish brown, grayish brown, and strong brown and is firm. The substratum to a depth of about 60 inches is mottled yellowish brown, light brownish gray, and strong brown sandy clay loam.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately well suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management generally are needed on this soil than on the less eroded Kenyon soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

84—Clyde silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in drainageways and on the lower concave foot slopes in the uplands. Individual areas are elongated or irregular in shape and range from 10 to more than 100 acres in size.

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 10 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam; the next part is light brownish gray, mottled, friable loam; and the lower part is mottled light brownish gray and yellowish brown, firm loam. The substratum to a depth of about 60 inches is mottled gray and strong brown loam. In places the surface soil is thicker.

Included with this soil in mapping are small areas of the somewhat poorly drained Floyd soils and the very poorly drained, mucky Palms soils. Floyd soils are commonly near the base of the upland side slopes. Palms soils are in landscape positions similar to those of the Clyde soil. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Clyde soil. Surface runoff is slow. Available water capacity is high. The content of organic matter is about 6 to 9 percent in the surface layer. The soil has a seasonal high water table at a depth of 1.0 to 2.5 feet. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. If drained and protected against runoff from the higher elevations, this soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Installing drainage tile is difficult in some areas because of the very friable, water-bearing sandy sediments. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture (fig. 7). Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, reduces the runoff rate, and damages the plant cover. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

109C—Backbone sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridges and side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsurface layer is dark grayish brown sandy loam about 5 inches thick. The subsoil is about 22 inches thick. The upper part is brown, friable sandy loam; the next part is dark yellowish brown, firm sandy clay loam; and the lower part is dark brown, reddish brown, and strong brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 36 inches. In places the surface layer is fine sandy loam or loamy sand. In some areas the slope is slightly less than 5 percent. In some small areas the surface layer is thinner and has a lower organic matter content.

Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part of the

Figure 7.—A pastured area of Clyde silty clay loam, 0 to 2 percent slopes.

subsoil. Surface runoff is medium. Available water capacity is low. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture. A few areas are cultivated. This soil is poorly suited to cultivated crops because it is droughty, is subject to wind erosion and water erosion, and has a limited root zone. Tillage may be difficult because of the shallowness to limestone bedrock. Cultivated crops should be grown only to help in reestablishing meadows. Measures that control runoff and help to prevent excessive soil and moisture losses are needed. A system of conservation tillage that leaves crop residue on the surface helps to control wind erosion and water erosion. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, increases the susceptibility to wind erosion and water erosion. Proper stocking rates, rotation grazing, and timely deferment of grazing, especially during dry periods, help to keep the pasture in good condition.

Many small areas support hardwood timber. This soil is moderately suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IVs.

109E—Backbone sandy loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, well drained soil is on convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsurface layer is dark grayish brown sandy loam about 3 inches thick. The subsoil is about 20 inches thick. The upper part is brown, friable sandy loam; the next part is dark yellowish brown, firm sandy clay loam; and the lower part is dark brown, strong brown, and reddish brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 30 inches.

Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part of the subsoil. Surface runoff is rapid or moderately rapid. Available water capacity is low. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture or trees. This soil generally is unsuitable for cultivated crops because it is subject to erosion, is droughty, and has a limited root zone.

A cover of pasture plants or hay helps to control erosion. Overgrazing, however, increases the susceptibility to wind erosion and water erosion. The number of livestock that can graze the pasture without damaging the plant cover is low. Proper stocking rates, rotation grazing, and deferment of grazing during dry periods help to keep the pasture in fair condition.

A few small areas support hardwood timber. This soil is moderately suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is VIs.

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

Typically, the surface layer is dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is brown fine sandy loam about 8 inches thick. The subsoil is very friable fine sandy loam about 35 inches thick. The upper part is yellowish brown, the next part is brown and dark yellowish brown, and the lower part is strong brown. Below this to a depth of about 60 inches is yellowish brown and brownish yellow loamy sand that has thin bands of brown material. In some areas the surface layer is very dark gray or very dark grayish brown fine sandy loam.

Included with this soil in mapping are small areas of the excessively drained Chelsea soils. These soils are more droughty than the Lamont soil and have a lower content of organic matter in the surface layer. They make up less than 10 percent of the unit.

Permeability is moderately rapid in the Lamont soil. Surface runoff is medium. Available water capacity is moderate. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture, but it is droughty unless rainfall is very timely. Wind erosion and water erosion are hazards if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to control wind erosion and water erosion and conserves moisture. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

110C—Lamont fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridges and side slopes in the uplands and on stream benches. Individual areas are irregularly shaped and are about 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is brown fine sandy loam about 8 inches thick. The subsoil is very friable fine sandy loam about 35 inches thick. The upper part is yellowish brown, the next part is brown and dark yellowish brown, and the lower part is strong brown. Below this to a depth of about 60 inches is yellowish brown and brownish yellow loamy sand that has thin bands of brown material. In some areas the surface layer is very dark gray or very dark grayish brown fine sandy loam.

Included with this soil in mapping are small areas of the excessively drained Chelsea soils. These soils are more droughty than the Lamont soil and have a lower content of organic matter in the surface layer. They make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Lamont soil.

Surface runoff is medium. Available water capacity is moderate. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture, but it is droughty. Wind erosion and water erosion are hazards if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to control wind erosion and water erosion and conserves moisture. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

110E—Lamont fine sandy loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, well drained soil is on ridges and side slopes in the uplands and on high stream benches. Individual areas are commonly long and narrow and are about 2 to 5 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 7 inches thick. The subsurface layer is brown and dark brown fine sandy loam about 4 inches thick. The subsoil is very friable fine sandy loam about 28 inches thick. The upper part is yellowish brown, the next part is brown and dark yellowish brown, and the lower part is strong brown. The substratum to a depth of about 60 inches is yellowish brown and brownish yellow loamy sand. It has thin bands of brown material. In some areas the surface layer is very dark gray or very dark grayish brown fine sandy loam, and in some small areas it is loamy fine sand.

Included with this soil in mapping are small areas of the excessively drained Chelsea soils. These soils have less clay than the Lamont soil. Also, they have a lower content of organic matter in the surface layer and are more droughty. They make up about 10 percent of the unit.

Permeability is moderately rapid in the Lamont soil. Surface runoff is rapid in cultivated areas. Available water capacity is moderate. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture or trees. A few areas are cultivated. This soil is generally unsuited to corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. Tilth generally is fair in the surface layer.

A cover of pasture plants or hay helps to control wind erosion and water erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Tree seedlings and cuttings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is VIe.

118—Garwin silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on concave slopes, at the head of drainageways, and in slight depressions on uplands. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer also is black silty clay loam. It is about 11 inches thick. The subsoil is about 27 inches thick. The upper part is very dark grayish brown, friable silty clay loam; the next part is dark gray, 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 grayish brown, mottled silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Muscatine soils. These soils are in the higher convex areas. They make up less than 5 percent of the unit.

Permeability is moderate in the Garwin soil. Surface runoff is slow. Available water capacity is high. The seasonal high water table is at a depth of 1 to 2 feet. The shrink-swell potential is high in the upper part of the soil. The content of organic matter is about 6 to 7 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain and to grasses for hay and pasture. It is suited to intensive row cropping but is generally wet during the spring. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if worked when wet. Drains are needed to lower the water table and improve the timeliness of fieldwork. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility and helps to maintain tilth.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIw.

119B—Muscatine silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on very broad ridges in the uplands. Individual areas are irregular in shape and range from 2 to 30 acres or more in size.

Typically, the surface layer is black silt loam about 6 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 12 inches thick. The subsoil is friable silty clay loam about 32 inches thick. The upper part is dark brown and dark grayish brown, the next part is grayish brown and mottled, and the lower part is light brownish gray and mottled. The substratum to a depth of about 60 inches is mottled light brownish gray, yellowish brown, and strong brown silt loam. In some areas the subsoil is brown or yellowish brown silty clay loam. In some places the substratum is yellowish brown, mottled loam, and in other places it is loamy sand or sand.

Permeability is moderate. Surface runoff is slow or medium. Available water capacity is high. This soil has a seasonal high water table at a depth of 2 to 4 feet. The content of organic matter is about 4 to 5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Overgrazing pasture or grazing when the soil is too wet causes surface compaction and results in poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

120B—Tama silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on broad ridges in the uplands. Individual areas are irregular in shape and range from 2 to 40 acres or more in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is about 11 inches thick. It is very dark brown silt loam in the upper part and very dark grayish brown silty clay loam in the lower part. The subsoil is friable silty clay loam about 28 inches thick. The upper part is dark grayish brown and brown, the next part is yellowish brown and mottled, and the lower part is mottled brown, pale brown, and strong brown. The substratum to a depth of about 60 inches is mottled brown, pale brown, and strong brown silt loam. In some places the surface layer is black silt loam. In other places the substratum is yellowish brown, mottled loam, sandy loam, or sand.

Included with this soil in mapping are small areas where slopes are less than 2 percent. These areas commonly make up less than 5 percent of the unit.

Permeability is moderate in the Tama soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, a system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping. In most areas slopes are long and uniform enough for terracing. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

120C—Tama silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 10 acres in size.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is friable silty clay loam about 28 inches thick. The upper part is brown and dark brown, and the lower part is dark yellowish brown and mottled. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the lower part of the subsoil and the substratum are loamy or sandy. In other places the surface layer is thinner and lighter colored.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by contour farming, a system of conservation tillage that leaves crop residue on the surface, and stripcropping. Slopes generally are long and uniform enough for terracing. Grassed waterways are needed to prevent the formation of gullies. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

129B—Arenzville-Chaseburg silt loams, 2 to 5 percent slopes. These gently sloping, moderately well drained and well drained soils are in narrow upland drainageways. They are occasionally flooded. Individual areas are about 100 to 200 feet wide and are long and narrow or irregularly shaped. They range from 25 to several hundred acres in size. They are about 50 percent Arenzville soil and 40 percent Chaseburg soil. The two soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Arenzville soil has a surface layer of dark grayish brown silt loam about 6 inches thick. The upper substratum is stratified dark grayish brown, brown, and pale brown silt loam about 20 inches thick. Below this is an old buried surface layer of black and very dark gray silt loam about 30 inches thick. The lower substratum to a depth of about 60 inches is dark grayish brown silt loam. In places the surface layer is dark brown and very dark grayish brown silt loam.

Typically, the Chaseburg soil has a surface layer of dark grayish brown silt loam about 10 inches thick. The substratum to a depth of more than 60 inches is multicolored, stratified silt loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Orion soils. These included soils are near the center of the drainageways. They make up about 10 percent of the unit.

Permeability is moderate in the Arenzville and Chaseburg soils. Surface runoff is medium. Available water capacity is high. The Arenzville soil has a seasonal high water table at a depth of 3 to 6 feet. The content of organic matter is about 1.0 to 2.5 percent in the surface layer of both soils. The soils generally have a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated or pastured along with the surrounding upland soils. Individual areas generally are too small to be cropped separately. If protected from flooding and erosion, these soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. The soils commonly receive high-velocity, concentrated runoff from the more sloping adjacent uplands. They can be protected from this excess water by diversion terraces on the adjoining upland slopes. In some areas they are seasonally wet because of seepage from the upland slopes. Installing tile in these areas improves the timeliness of fieldwork. Structures that keep gullies from forming are needed in some areas.

Some small inaccessible areas along narrow drainageways are used as permanent pasture. These soils are well suited to pasture. Overgrazing or grazing when the soils are too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to most trees. Because they receive runoff from the more sloping upland soils, however, they tend to remain wet for moderately long periods after rainfall. Tree cuttings and seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying or cutting.

The land capability classification is IIe.

133—Colo silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on alluvial flood plains and in narrow drainageways on uplands. It is occasionally flooded. Individual areas are long and irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black silty clay loam about 30 inches thick. The subsoil is very dark gray silty clay loam about 10 inches thick. The substratum to a depth of 60 inches is dark gray and mottled light olive gray, dark gray, and light brownish gray silty clay loam.

Included with this soil in mapping are a few areas of Sawmill soils. These soils have a surface layer that is thinner than that of the Colo soil. Also included are some areas near alluvial fans or along the stream channel where the soil has 6 to 10 inches of silt loam overwash. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Colo soil. Surface runoff is slow. Available water capacity is high. The seasonal high water table is at a depth of 1 to 3 feet. The content of organic matter is about 5 to 7 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are used for cultivated crops or hay. A few undrained areas are used for pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Tilth generally is fair in the surface layer. This soil tends to puddle if worked when wet. Cultivation is often delayed unless the soil is drained. When installed, subsurface drains work fairly well if adequate outlets are available. Because of the flooding, a good stand of row crops is difficult to establish in some years. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility and maintains good tilth.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIw.

136—Ankeny fine sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on alluvial fans, stream terraces, and foot slopes at the base of the uplands. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is black fine sandy loam about 7 inches thick. The subsurface layer is very dark brown fine sandy loam about 31 inches thick. The subsoil is brown, very friable sandy loam about 9 inches thick. Below this to a depth of about 60 inches are bands of brown fine sand, brown and dark brown sandy loam, and yellowish brown fine sand. In places the surface layer is loamy sand.

Permeability is moderately rapid. Surface runoff is slow. Available water capacity is moderate. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. A few areas are used as permanent pasture. If it is protected from local runoff and receives timely rainfall during the growing season, this soil is well suited to corn, soybeans, and small grain. Some areas receive runoff from the adjoining uplands during periods of heavy rainfall. In places diversion terraces help to control the overflow from the higher elevations and the resulting siltation. Droughtiness is a limitation in years when rainfall is below average or is not timely. Wind erosion is a hazard if the surface is not protected. A system of conservation tillage that leaves crop residue on the surface helps to conserve moisture and prevent excessive soil loss. Good tilth generally can be easily maintained.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

142—Chaseburg silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on narrow bottom land, on alluvial fans, and in upland drainageways. It is frequently flooded. Individual areas are elongated and range from 2 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The substratum to a depth of about 60 inches is multicolored, stratified silt loam.

Included with this soil in mapping are small areas of the excessively drained Perks soils. These soils are in positions on the landscape similar to those of the Chaseburg soil. They make up less than 15 percent of the unit.

Permeability is moderate in the Chaseburg soil. Surface runoff is slow. Available water capacity is very high. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. A few are used for pasture. If protected from flooding, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It receives high-velocity floodwater during periods of heavy rainfall. The floodwater can damage crops in some years. It can be controlled by levees and dikes. Good tilth generally can be easily maintained.

Many narrow, frequently flooded areas are used as permanent pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and puddling. Rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIw.

143B—Brady sandy loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on concave foot slopes and in outwash areas at the base of upland side slopes and on stream terraces. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsurface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is brown, mottled, friable sandy loam; the next part is mottled light brownish gray, yellowish brown, and strong brown, friable sandy loam; and the lower part is mottled light gray, yellowish brown, and strong brown, very friable loamy sand. The substratum to a depth of about 60 inches is light brownish gray and pale brown sand.

Included with this soil in mapping are small areas of the poorly drained Granby soils. These soils are in slight depressions on stream terraces. They make up less than 5 percent of the unit.

Permeability is moderately rapid in the upper part of the Brady soil and very rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for cultivated crops, hay, or pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If the soil is used for cultivated crops, it is subject to wind erosion. Conservation practices that leave crop residue on the surface reduce excessive soil loss. Good tilth can be easily maintained. The water table is high in the spring but drops rapidly during the growing season. Subsurface drains are beneficial during wet periods, but they are difficult to install and maintain because of the underlying loose sand. The soil may become droughty during periods of low rainfall. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet and very dry periods help to keep the pasture in good condition.

A few areas support hardwood timber. This soil is moderately well suited to trees. Tree seeds, cuttings, and seedlings survive and grow well when precipitation is normal. Competing vegetation should be controlled or removed by site preparation, prescribed burning, or spraying, cutting, or girdling.

The land capability classification is IIe.

152—Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, poorly drained soil is in drainageways that are filled with erosional sediments and on stream terraces. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is black loam about 15 inches thick. Below this is a transitional layer of very dark grayish brown clay loam about 6 inches thick. The subsoil is about 14 inches thick. The upper part is grayish brown, friable clay loam, and the lower part is mottled grayish brown, light yellowish brown, and brownish yellow, friable sandy loam. The substratum to a depth of about 60 inches is light brownish gray sand that has fine pebbles. In places the depth to sand and gravel is more than 40 inches.

Permeability is moderate in the surface layer and subsoil and very rapid in the substratum. Runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table at a depth of 1.0 to 2.5 feet. The content of organic matter is about 5 to 6 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated and have been drained. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If the soil is not drained, the seasonal high water table may cause crop damage during periods of above normal rainfall. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A few areas are used for pasture or hay. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

153—Shandep loam, 0 to 1 percent slopes. This level, very poorly drained soil is in slight depressions on stream terraces and in outwash areas. It is subject to ponding. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is black clay loam about 23 inches thick. The subsoil is about 27 inches thick. The upper part is dark gray, friable clay loam; the next part is gray, mottled, friable clay loam; and the lower part is very dark gray, friable loam that has a high content of coarse sand. The substratum to a depth of about 60 inches is dark gray loamy sand. In places the depth to loamy sand and sand is less than 48 inches.

Permeability is moderate in the surface soil and subsoil and rapid in the substratum. Runoff is very slow or is ponded in some of the depressions. Available water capacity is high. The soil has a seasonal high water table at a depth of about 1 foot. The content of organic matter is about 7 to 9 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated and have been drained. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table and the ponding may cause crop damage during periods of above normal rainfall. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to pasture and hayland. Overgrazing or grazing when the soil is too 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 in good condition.

The land capability classification is IIIw.

159—Finchford loamy sand, 0 to 2 percent slopes. This nearly level, excessively drained soil is on stream terraces. Individual areas are irregular in shape and somewhat elongated and range from 2 to 30 acres in size.

Typically, the surface layer is very dark brown loamy sand about 9 inches thick. The subsurface layer is very dark grayish brown loamy sand about 11 inches thick. The subsoil is dark brown loose sand about 22 inches thick. The substratum to a depth of about 60 inches is yellowish brown gravelly sand.

Permeability is very rapid. Surface runoff is slow. Available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Many small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. Droughtiness is a severe hazard in most years unless rainfall is timely. Wind erosion is a hazard during most years. Windblown sand grains can damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture during periods of low humidity and high-velocity winds. Tilth generally is poor in the surface layer. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

Many areas are used for pasture or hay. Overgrazing or grazing when the soil is too wet or too dry reduces the extent of the plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The land capability classification is IVs.

159C—Finchford loamy sand, 2 to 9 percent slopes. This gently sloping and moderately sloping, excessively drained soil is on convex side slopes and escarpments on stream terraces. Slopes are typically short. Individual areas are irregular in shape or elongated and range from 2 to 15 acres in size.

Typically, the surface layer is very dark brown or very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is very dark grayish brown loamy sand about 10 inches thick. The subsoil is dark brown, loose sand about 18 inches thick. The substratum to a depth of about 60 inches is yellowish brown gravelly sand.

Permeability is very rapid. Surface runoff is medium or slow. Available water capacity is low. The content of organic matter is about 0.5 to 1.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorous and a very low supply of available potassium.

Most areas are cultivated. A few small areas are cropped along with larger areas of adjacent soils that are well suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. Droughtiness is a severe hazard in most years unless rainfall is timely. If cultivated crops are grown, wind erosion is a hazard. Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. Tilth generally is poor in the surface layer. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The land capability classification is IVs.

162B—Downs silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on narrow ridges in the uplands. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places the surface layer is thicker and darker.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and stripcropping help to prevent excessive soil loss. Slopes generally are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIe.

162C—Downs silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 41 inches thick. It is friable. In sequence downward, it is dark grayish brown silt loam, dark yellowish brown silty clay loam, yellowish brown silty clay loam, and yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places the surface layer is thinner and lower in content of organic matter.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained. The surface layer is friable, but it tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

162C2—Downs silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. It has streaks and pockets of brown material. The subsoil is about 38 inches thick. It is friable. The upper part is brown silty clay loam, the next part is dark yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In some places the surface layer is brown silty clay loam. In other places it is very dark brown silt loam.

Permeability is moderate. Surface runoff is medium. The content of organic matter is about 2 to 3 percent in the surface layer. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Downs soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

162D—Downs silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on long, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 32 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the surface layer is thinner.

Included with this soil in mapping are small areas of Orwood soils. These soils formed in loamy and silty eolian material. They are in positions on the landscape similar to those of the Downs soil. They make up less than 10 percent of the unit.

Permeability is moderate in the Downs soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a very low supply of potassium.

Most areas have been cleared of trees and are cultivated. A few areas are used for pasture. This soil is moderately well suited to corn and soybeans that are occasionally grown in rotation with small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

162D2—Downs silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on long, convex side slopes in the uplands. Individual areas are commonly narrow and somewhat elongated and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. It has streaks and pockets of brown material. The subsoil is about 34 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places the surface layer is brown silty clay loam.

Included with this soil in mapping are small areas of Orwood soils. These soils formed in coarse silts and fine sands. They are in positions on the landscape similar to those of the Downs soil. They make up less than 10 percent of the unit.

Permeability is moderate in the Downs soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn and soybeans that are occasionally grown in rotation with small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

More nitrogen and more intensive management are needed on this soil than on the less eroded Downs soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

163B—Fayette silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on moderately wide ridgetops in the uplands. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Included with this soil in mapping are some small areas that have loam glacial till at a depth of 40 to 60 inches. These areas are commonly in strongly dissected, loess-capped areas at the base of upland slopes rather than on the ridgetops. Most of the areas are in sections 16 and 17 of T. 86 N., R. 2 W.

Permeability is moderate in the Fayette soil. Surface runoff is medium in cultivated areas. Available water capacity is high or very high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIe.

163C—Fayette silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Individual areas are generally long and irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the surface layer is dark grayish brown silt loam about 7 inches thick. In other places the surface layer is mixed with subsoil material, the content of organic matter is lower, and tilth is poorer.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

163C2—Fayette silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to more than 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 35 inches thick. It is yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the surface layer is brown silty clay loam. In other places it is less than 6 inches thick.

Included with this soil in mapping are some small areas of soils that have loam glacial till at a depth of 40 to 60 inches. These areas are commonly in strongly dissected, loess-capped areas at the base of upland slopes rather than on the ridgetops or side slopes. Most of the areas are in sections 16 and 17 of T. 86 N., R. 2 W.

Permeability is moderate in the Fayette soil. Surface runoff is medium in cultivated areas. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and grassed waterways help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Fayette soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

163D—Fayette silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on long, convex side slopes in the uplands. Individual areas are elongated and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark gray and dark grayish brown silt loam about 6 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is brown silt loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown, mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the surface layer is dark grayish brown silt loam about 7 inches thick. In other places the surface layer is mixed with subsoil material, the content of organic matter is lower, and tilth is poorer.

Included with this soil in mapping are small areas of Dubuque soils on the lower part of side slopes. These soils have limestone bedrock at a depth of 20 to 40 inches. They make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil. Surface runoff is rapid in cultivated areas. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used for woodland or permanent pasture. A few areas have been cleared of trees and are cultivated. This soil is moderately well suited to corn and soybeans that are grown in rotation with small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. Slopes commonly are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

163D2—Fayette silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Individual areas are elongated and range from 2 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 35 inches thick. It is yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the surface layer is thinner. In other places it is brown silty clay loam.

Included with this soil in mapping are small areas of Dubuque soils. These soils are on convex side slopes. They have limestone bedrock at a depth of 20 to 40 inches. They make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil. Surface runoff is rapid in cultivated areas. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. A few are used for pasture. This soil is moderately well suited to occasional row crops that are grown in rotation with small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and grassed waterways help to prevent excessive soil loss (fig. 8). Slopes commonly are long enough and uniform enough for terracing and contour farming. Tilth generally is good in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Fayette soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

163E—Fayette silt loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on long, convex side slopes in the uplands. Individual areas are elongated and range from 2 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark gray and dark grayish brown silt loam about 4 inches thick. The subsoil is about 35 inches thick. It is friable. The upper part is brown silt loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown, mottled silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is dark grayish brown silt loam.

Included with this soil in mapping are small areas of Dubuque, Exette, and Lindley soils. Dubuque soils are in landscape positions similar to those of the Fayette soil. They have limestone bedrock at a depth of 20 to

Figure 8.—Contour stripcropping in an area of Fayette silt loam, 9 to 14 percent slopes, moderately eroded.

40 inches. Exette soils generally are in the coves of upland drainageways. They have mottles within a depth of 30 inches. Lindley soils are typically on side slopes below the Fayette soil. They have a loam surface layer and are underlain by glacial till. Included soils make up less than 5 percent of the unit.

Permeability is moderate in the Fayette soil. Surface runoff is rapid in cultivated areas. Available water capacity is high or very high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used for woodland. Some are used as permanent pasture. This soil is poorly suited to corn and soybeans. It is best suited to grasses and legumes for hay and pasture. Small grain should be grown only to help in establishing legumes. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Tilth generally is good in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Most areas support hardwood timber. This soil is moderately suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is IVe.

163E2—Fayette silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on convex side slopes in the uplands. Individual areas are elongated and range from 2 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 34 inches thick. It is friable. The upper part is dark yellowish brown silt loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown, mottled silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is brown silty clay loam.

Included with this soil in mapping are some small areas of Dubuque, Lindley, and Nordness soils on the lower part of side slopes and Exette soils in the coves of upland drainageways. Dubuque soils are underlain by limestone bedrock at a depth of 20 to 40 inches. Exette soils have gray mottles within a depth of 30 inches. Lindley soils have a loam surface layer underlain by glacial till. Nordness soils are underlain by limestone bedrock at a depth of 8 to 20 inches. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil. Surface runoff is rapid in cultivated areas. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Many areas are cultivated. A few are used for pasture. This soil is poorly suited to corn, soybeans, and small grain. It is best suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. Tilth generally is poor in the surface layer. If cultivated, the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Fayette soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is IVe.

163F—Fayette silt loam, 18 to 25 percent slopes. This steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are narrow and elongated and range from 2 to 25 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark gray and dark grayish brown silt loam about 4 inches thick. The subsoil is about 35 inches thick. It is friable. The upper part is brown silt loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown, mottled silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is dark grayish brown silt loam.

Included with this soil in mapping are small areas of Dubuque and Nordness soils on the lower part of side slopes. Dubuque soils are 20 to 40 inches deep over limestone bedrock. Nordness soils are 8 to 20 inches deep over limestone bedrock. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used for woodland. Some are used as permanent pasture. This soil generally is unsuitable for cultivated crops because of the slope and a severe hazard of erosion. It is better suited to permanent pasture. Operating farm machinery is difficult because of the slope and because of gullies and waterways. Tilth generally is good. If the soil is cultivated, the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Most areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is VIe.

163F2—Fayette silt loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are narrow and elongated and range from 2 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 33 inches thick. It is friable. The upper part is dark yellowish brown silt loam, the next part is yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In some places the surface layer is brown silty clay loam, and in other places it is thinner.

Included with this soil in mapping are small areas of Dubuque, Exette, and Nordness soils. Exette soils have gray mottles within a depth of 30 inches. They are commonly in the coves of upland drainageways. Dubuque soils are 20 to 40 inches deep over limestone bedrock. Nordness soils are 8 to 20 inches deep over limestone bedrock. Dubuque and Nordness soils are on the lower part of the side slopes. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Fayette soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Many areas are cultivated. Some are used for pasture. This soil generally is unsuitable for cultivated crops because of the slope and a severe hazard of erosion. It is better suited to permanent pasture. Operating farm machinery is difficult because of the slope and because of gullies and waterways. If cultivated crops are grown, further erosion is a severe hazard. Cultivated crops should be grown only to help in reestablishing grasses and legumes for hay and pasture. Tilth generally is poor. In cultivated areas the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in fair condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is VIe.

163G—Fayette silt loam, 25 to 40 percent slopes. This very steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are narrow and elongated and range from 2 to 15 acres in size.

Typically, the surface layer is very dark gray silt loam about 2 inches thick. The subsurface layer is gray and dark grayish brown silt loam about 4 inches thick. The subsoil is about 32 inches thick. It is friable. The upper part is brown silt loam; the next part is yellowish brown silty clay loam; and the lower part is yellowish brown, mottled silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. In places the surface layer is dark grayish brown.

Included with this soil in mapping are small areas of Nordness soils on the steepest part of the side slopes. These soils are 8 to 20 inches deep over limestone bedrock. They make up less than 10 percent of the unit.

Permeability is moderate in the Fayette soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Nearly all areas are wooded or used as permanent pasture. This soil generally is unsuited to cultivated crops and hay because of the slope and a severe hazard of erosion. It is best suited to permanent pasture and woodland. Ordinary farm machinery commonly cannot be used because of the slope. Tilth generally is good in the surface layer.

Most areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is VIIe.

171B—Bassett loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on long, convex ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 20 to 40 acres in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown and brown, firm loam; and the lower part is brown, mottled, firm loam. The substratum to a depth of about 60 inches is strong brown, mottled loam. In some areas the surface layer is very dark gray.

Included with this soil in mapping are a few small areas of sandy soils on the side slopes. These soils are droughty during years that have below average rainfall. They make up less than 5 percent of the unit.

Permeability is moderate in the Bassett soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth. A combination of terracing and tiling is needed in some areas. Terrace cuts should not expose the less productive underlying glacial till, which is low in fertility and cannot be easily cultivated.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIe.

171C—Bassett loam, 5 to 9 percent slopes. This moderately sloping, moderately well drained soil is on ridges and short, convex side slopes in the uplands. Individual areas are elongated and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown and brown, firm loam; and the lower part is brown, mottled, firm loam. The substratum to a depth of 60 inches is strong brown, mottled loam. In some areas the surface layer is very dark gray.

Included with this soil in mapping are a few small areas of sandy soils on the side slopes. These areas are droughty during years that have below average rainfall. They make up less than 5 percent of the unit.

Permeability is moderate in the Bassett soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent deterioration of tilth. In some areas a combination of tile drains and terraces is needed. Terrace cuts should not expose the less productive underlying glacial till, which is low in fertility and cannot be easily cultivated or revegetated.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, moderately well drained soil is on short, convex side slopes in the uplands. Individual areas are elongated and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 32 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown and brown, firm loam; and the lower part is brown, mottled, firm loam. The substratum to a depth of about 60 inches is strong brown, mottled loam. In some areas the surface layer is brown loam.

Included with this soil in mapping are a few small areas of sandy soils. These soils are more droughty than the Bassett soil and are lower in fertility. They make up less than 5 percent of the unit.

Permeability is moderate in the Bassett soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. If well managed, this soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Further erosion is a severe hazard if cultivated crops are grown. Tilth generally is fair in the surface layer. More nitrogen and more intensive management are needed on this soil than on the less eroded Bassett soils. Farming on the contour and terracing help to control erosion. A combination of measures, such as tile drains and terraces, or a system of conservation tillage that leaves crop residue on the surface is needed in some areas. Fieldwork may be slightly delayed during wet periods.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by careful site preparation or by spraying or cutting.

The land capability classification is IIIe.

171D—Bassett loam, 9 to 14 percent slopes. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown and brown, firm loam; and the lower part is brown, mottled, firm loam. The substratum to a depth of about 60 inches is strong brown, mottled loam. In some areas the surface layer is very dark gray. In other areas it is silt loam.

Included with this soil in mapping are a few small areas of sandy soils. These soils are more droughty than the Bassett soil and are lower in fertility. They make up less than 5 percent of the unit.

Permeability is moderate in the Bassett soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture or cultivated crops. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Good tilth generally can be easily maintained. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, moderately well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. It has brown streaks and pockets of subsoil material. Plowing has mixed subsoil material into the surface layer. The subsoil is about 32 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown and brown, firm loam; and the lower part is brown, mottled, firm loam. The substratum to a depth of about 60 inches is strong brown, mottled loam. In some areas the surface layer is silt loam. In other areas it is about 7 inches thick.

Included with this soil in mapping are a few small areas of sandy and gravelly soils. These soils are more droughty than the Bassett soil and are lower in fertility. They make up less than 10 percent of the unit.

Permeability is moderate in the Bassett soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture or cultivated crops. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to prevent excessive soil loss. Tilth generally is fair in the surface layer. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Bassett soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

171E2—Bassett loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, moderately well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 5 acres in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. It has brown streaks and pockets of subsoil material. Plowing has mixed subsoil material into the surface layer. The subsoil is about 28 inches thick. The upper part is brown and dark yellowish brown, friable loam; the next part is yellowish brown and brown, firm loam; and the lower part is brown, mottled, firm loam. The substratum to a depth of about 60 inches is strong brown, mottled loam.

Included with this soil in mapping are a few small areas of sandy and gravelly soils. These soils are more droughty than the Bassett soil and are lower in fertility. They make up less than 10 percent of the unit.

Permeability is moderate in the Bassett soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are used for pasture or cultivated crops. This soil is poorly suited to corn, soybeans, and small grain and is moderately well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. In most areas slopes are too short and too steep for terracing, but some areas can be terraced along with the less sloping soils upslope. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Bassett soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is moderately suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is IVe.

174B—Bolan loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on convex ridge crests, nose slopes, and side slopes in the uplands and on outwash terraces. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is black loam about 10 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part is dark brown and brown, friable loam, and the lower part is dark yellowish brown, very friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy fine sand. In places the surface layer is fine sandy loam.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Surface runoff is medium. Available water capacity is moderate. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Droughtiness is a limitation. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Terrace cuts should not expose the coarse textured material. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to control erosion, and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Erosion is a hazard, however, if overgrazing reduces the extent of the protective plant cover. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

174C—Bolan loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on convex side slopes in the uplands and on outwash terraces. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part is dark brown and brown, friable loam, and the lower part is dark yellowish brown, very friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown loamy fine sand. In places the surface layer is fine sandy loam.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Surface runoff is medium. Available water capacity is moderate. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Droughtiness is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Terrace cuts should not expose the coarse textured material. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to control erosion, and helps to maintain good tilth.

A cover of pasture plants or hay is effective in controlling erosion. Erosion is a hazard, however, if overgrazing reduces the extent of the protective plant cover. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIIe.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is on convex ridge crests, nose slopes, and side slopes in the uplands and on stream terraces. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 11 inches thick. The subsoil is about 24 inches thick. It is very friable. The upper part is brown fine sandy loam, the next part is yellowish brown fine sandy loam, and the lower part is yellowish brown loamy fine sand. The substratum to a depth of 60 inches is yellowish brown and dark yellowish brown loamy fine sand.

Permeability is moderately rapid. Surface runoff is medium. Available water capacity is low. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some areas are used for pasture or hay. Many small areas are cropped with larger areas of adjacent soils. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a hazard in most years unless rainfall is timely. Wind erosion is a hazard in areas where cultivated crops are grown. Windblown sand grains can damage newly seeded crops on this soil and on the adjoining soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. The soil is poorly suited to terracing because ridging the moderately coarse textured material is difficult and because the underlying coarse textured material is too close to the surface. Terrace cuts should not expose the coarse textured material. The soil warms up quickly in the spring, thus stimulating early plant growth. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the available water capacity.

If this soil is used for pasture, overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during excessively wet or dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

175C—Dickinson fine sandy loam, 5 to 9 percent slopes. This moderately sloping, somewhat excessively drained soil is on ridges, nose slopes, and side slopes in the uplands and on stream terraces. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 6 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 25 inches thick. It is very friable. The upper part is brown fine sandy loam, the next part is yellowish brown loamy fine sand, and the lower part is yellowish brown loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown loamy fine sand. In some places the subsoil is brown loam. In other places the surface layer is thinner and lighter colored.

Permeability is moderately rapid. Surface runoff is medium. Available water capacity is low. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated or used for hay and pasture. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, wind erosion and water erosion are hazards. Stripcropping, a system of conservation tillage that leaves crop residue on the surface, contour farming, terraces, or a combination of these can help to prevent excessive soil loss. Terrace cuts should not expose the coarse textured material. The soil is droughty during periods of below normal rainfall. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture, improves fertility, and helps to maintain tilth.

If this soil is used for pasture, overgrazing causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

177—Saude loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 6 inches thick. The subsoil is about 16 inches thick. The upper part is dark brown and dark yellowish brown, friable loam, and the lower part is dark yellowish brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand.

Permeability is moderate in the upper part of the profile and very rapid in the lower part. Surface runoff is slow. Available water capacity is low. The content of organic matter is about 3.5 to 4.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a hazard in most years unless rainfall is timely. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

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

The land capability classification is IIs.

177B—Saude loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream terraces. Individual areas are irregular in shape or somewhat elongated and range from 2 to 20 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown loam about 6 inches thick. The subsoil is about 16 inches thick. The upper part is dark brown and dark yellowish brown, friable loam, and the lower part is dark yellowish brown, very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand.

Included with this soil in mapping are small areas of soils that have a gravelly loamy sand surface layer. These soils are lower in organic matter content than the Saude soil and have a lower available water capacity. They are in positions on the landscape similar to those of the Saude soil. They make up less than 5 percent of the unit.

Permeability is moderate in the upper part of the Saude soil and very rapid in the lower part. Surface runoff is medium. Available water capacity is low. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. The soil is poorly suited to terracing because the coarse textured material is too close to the surface. Terrace cuts should not expose the course textured material in terrace channels. Droughtiness is a hazard in most years unless rainfall is timely. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

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

The land capability classification is IIe.

178—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown and very grayish brown loam about 13 inches thick. The subsoil is about 17 inches thick. The upper part is brown, friable loam, and the lower part is dark yellowish brown, friable sandy loam and very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand.

Included with this soil in mapping are small areas of soils that have a loamy sand, sand, or gravelly loamy sand surface layer. These soils are lower in organic matter content than the Waukee soil and have a lower available water capacity. They are in positions on the landscape similar to those of the Waukee soil. Also included are small areas of poorly drained soils in slight depressions. Tillage is delayed in these areas unless a drainage system is installed. Included soils make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Waukee soil and very rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. The content of organic matter is about 3.5 to 4.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a hazard in most years unless rainfall is timely. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

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

The land capability classification is IIs.

178B—Waukee loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown loam about 13 inches thick. The subsoil is about 17 inches thick. The upper part is brown, friable loam, and the lower part is dark yellowish brown, friable sandy loam and very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand.

Included with this soil in mapping are small areas of soils that have a loamy sand, sand, or gravelly loamy sand surface layer. These soils are lower in organic matter content than the Waukee soil and have a lower available water capacity. They are in positions on the landscape similar to those of the Waukee soil. They make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Waukee soil and very rapid in the lower part. Surface runoff is medium. Available water capacity is moderate. The content of organic matter is 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. Some are used for hay or pasture. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

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

The land capability classification is IIe.

184B—Klinger silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on broad divides, slightly convex ridgetops, and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to more than 40 acres in size.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is very dark gray silty clay loam about 6 inches thick. The subsoil is about 35 inches thick. The upper part is dark grayish brown, friable silty clay loam; the next part is grayish brown, mottled, friable silty clay loam; and the lower part is mottled grayish brown and yellowish brown, firm loam. The substratum to a depth of 60 inches is mottled light brownish gray and yellowish brown loam. In places the surface layer is thinner and lighter colored.

Permeability is moderate. Surface runoff is slow. Available water capacity is high. This soil has a seasonal high water table at a depth of 2 to 4 feet. The content of organic matter is about 4.5 to 5.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion can be a hazard. A conservation tillage system that leaves crop residue on the surface helps to prevent excessive soil loss. In some areas tile drainage is needed to reduce the wetness and improve the timeliness of fieldwork. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Some areas are used for pasture or hay. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

198B—Floyd loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on concave slopes and on the lower side slopes along upland drainageways. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown loam about 16 inches thick. The subsoil is about 25 inches thick. In sequence downward, it is dark grayish brown, mottled, friable loam; mottled grayish brown and yellowish brown, friable sandy clay loam; olive brown, mottled, very friable sandy loam; and mottled light brownish gray and strong brown, firm loam. The substratum to a depth of about 60 inches is mottled light brownish gray and strong brown loam. In places the surface soil is thinner and lighter colored.

Included with this soil in mapping are small areas of the poorly drained Clyde soils in drainageways. These soils make up about 10 percent of the unit.

Permeability is moderate in the Floyd soil. Surface runoff is slow. Available water capacity is high. The soil has a seasonal high water table at a depth of 2 to 4 feet. The content of organic matter is about 5 to 6 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion can be a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. A subsurface drainage system generally is needed to lower the water table and improve the timeliness of fieldwork. Installing tile is difficult in some areas because of the very friable, water-bearing sandy sediments in the lower part of the profile. Conservation measures, such as diversions, may be needed to control surface runoff from the adjacent side slopes. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

221—Palms muck, 0 to 3 percent slopes. This nearly level and very gently sloping, very poorly drained soil commonly is in spring-fed, seepy areas in drainageways, on outwash terraces, and in depressions on bottom land. It is subject to ponding. Individual areas are irregular in shape and range from 2 to 20 acres or more in size.

Typically, the surface layer is black muck about 13 inches thick. The subsurface layer is black muck about 18 inches thick. The substratum to a depth of about 60 inches is dark gray, friable silt loam. In some areas it is black silt loam.

Included with this soil in mapping are small areas of Aquolls, ponded. These soils are in landscape positions similar to those of the Palms soil. They make up about 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the mucky part of the Palms soil and moderately slow to moderate in the substratum. Surface runoff is very slow. Available water capacity is very high. The soil has a seasonal high water table near or above the surface. The content of organic matter is commonly more than 20 percent in the surface layer. The substratum generally has a very low supply of available phosphorus and potassium.

Most of the acreage is undrained and is idle land. If drained, this soil is moderately well suited to corn and soybeans. It is suited to small grain, but the plants may lodge and yields will be reduced. The soil generally is wet because it is in or near seepy areas or it is near natural springs where water that is frequently under pressure seeps to the surface. Installing an adequate drainage system is difficult. Locating suitable outlets is difficult in some areas. A system that is designed to intercept the seepage water is the most successful. If the soil is drained, shrinkage of the organic material can alter tile alignment and cause the drainage system to function improperly. The loss of moisture content can result in a severe hazard of wind erosion. Tilth generally is good in the surface layer.

This soil is poorly suited to pasture because of the high water table and the organic material. The sedges, willow trees, and other water-tolerant plants that grow on this soil are generally undesirable as livestock feed. The spongy material cannot withstand the traffic of grazing livestock. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition and help to control the growth of undesirable species, such as sedges and willows.

Because this soil has a seasonal high water table and remains wet for long periods after rainfall, it is poorly suited to trees. Special equipment commonly is needed. Operating this equipment is difficult, however, because of the spongy surface layer. A drainage system is needed to reduce the seedling mortality rate.

The land capability classification is IIIw.

226—Lawler silt loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream terraces.

Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam and loam about 13 inches thick. The subsoil is about 17 inches thick. The upper part is dark grayish brown, 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 mottled strong brown, yellowish brown, and grayish brown loamy sand, sand, and gravelly sand. In some places the subsurface layer is dark grayish brown and grayish brown loam about 4 inches thick. In other places the depth to the sandy substratum is less than 32 inches.

Included with this soil in mapping are small areas of the poorly drained, loamy Marshan soils. These soils are in landscape positions similar to those of the Lawler soil or are in slight depressions. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the Lawler soil and very rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table at a depth of 2 to 4 feet. The content of organic matter is about 4 to 5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Subsurface drainage tile can lower the water table and remove excess moisture during wet periods. The soil may become droughty during periods of low rainfall. A system of conservation tillage that leaves crop residue on the surface helps to reduce moisture loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in improving soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIs.

246—Curran silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on low stream terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 45 inches thick. In sequence downward, it is dark grayish brown, friable silt loam; brown, mottled, friable silt loam; mottled light brownish gray, light olive brown, dark yellowish brown, and yellowish brown, friable silt loam; and mottled pale brown and yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is mottled pale brown and yellowish brown sand. In places the surface layer is thicker. It formed in lighter colored, stratified, recently deposited sediments.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 1 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. It may remain slightly wet, however, and receives runoff from the soils upslope. Establishing diversion terraces on the soils upslope helps to protect this soil from runoff and siltation. Tile drainage helps to lower the water table and improves the timeliness of fieldwork. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent surface crusting.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support native hardwoods. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The capability classification is IIw.

246B—Curran silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on foot slopes and low stream terraces. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 45 inches thick. In sequence downward, it is dark grayish brown, friable silt loam; brown, mottled, friable silt loam; mottled light brownish gray, light olive brown, dark yellowish brown, and yellowish brown, friable silt loam; and mottled pale brown and yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is mottled pale brown and yellowish brown sand. In places the surface layer is thicker. It formed in lighter colored, stratified, recently deposited sediments.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Surface runoff is medium. Available water capacity is moderate. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 1 to 3 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain. It may remain slightly wet, however, and receives runoff from the soils upslope. Establishing diversion terraces on the soils upslope helps to protect this soil from runoff and siltation. Tile drainage helps to lower the water table and improves the timeliness of fieldwork. If this soil is used for intensive row cropping, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to prevent surface crusting.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIe.

284B—Flagler sandy loam, 1 to 5 percent slopes. This very gently sloping and gently sloping, somewhat excessively drained soil is on stream terraces. Individual areas are long and narrow or irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is black sandy loam about 7 inches thick. The subsurface layer is black and very dark brown sandy loam about 13 inches thick. The subsoil is about 17 inches thick. It is very friable. The upper part is dark brown sandy loam, the next part is brown and dark yellowish brown sandy loam, and the lower part is yellowish brown loamy sand. The substratum to a depth of about 60 inches is yellowish brown loamy sand and sand that contains some fine gravel.

Included with this soil in mapping are some small areas of the well drained Saude and Waukee soils. These soils have more clay in the upper part of the profile than the Flagler soil. Also included are small areas of Finchford soils, which have more gravel throughout than the Flagler soil. Included soils make up less than 5 percent of the unit.

Permeability is moderately rapid in the upper part of the Flagler soil and very rapid in the lower part. Surface runoff is slow or medium. Available water capacity is low. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Many small areas are cropped within larger areas of adjacent soils that are better suited to crops. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a limitation in most years unless rainfall is timely. Wind erosion is a hazard during most years. Windblown sand grains can damage new seedlings on this soil and on the adjoining soils. A conservation tillage system that leaves crop residue on the surface and cover crops help to prevent excessive soil loss and conserve moisture during periods of low rainfall and high-velocity winds. Tilth generally is fair in the surface layer. The soil is poorly suited to terracing. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration and the available water capacity.

Some areas are used for pasture and hay. A cover of grasses or legumes is generally effective in controlling erosion. Overgrazing, however, reduces the extent of the protective plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

290—Dells silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream terraces. It is subject to rare flooding. Individual areas are irregular in shape or somewhat elongated and range from 2 to 20 acres in size.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 20 inches thick. It is mottled. The upper part is brown, friable silty clay loam, and the lower part is light brownish gray and pale brown, very friable sandy loam. The substratum to a depth of about 60 inches is brown loamy sand. In some areas the depth to coarse textured material is more than 36 inches.

Included with this soil in mapping are small areas of poorly drained soils in depressions. These soils make up less than 5 percent of the unit.

Permeability is moderate in the upper part of the Dells soil and rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The water table is moderately high in the spring but drops rapidly during the growing season. In some areas tile drainage is beneficial during wet periods, but installing drainage tile may be difficult because of the loose, water-bearing sand and gravel. Droughtiness is a limitation during periods of below normal rainfall. A system of conservation tillage that leaves crop residue on the surface helps conserve soil moisture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay tends to improve soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality and the limitations that affect planting and harvesting are slight.

The land capability classification is IIw.

291B—Atterberry silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is on upland divides and high stream benches. Individual areas are broad and irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 36 inches thick. It is mottled and friable. The upper part is brown silty clay loam, the next part is light brownish gray and grayish brown silty clay loam, and the lower part is light brownish gray and yellowish brown silt loam. The substratum to a depth of about 60 inches is mottled light olive gray, light brownish gray, and yellowish brown silt loam. In some places coarse sand is at a depth of 55 to 60 inches. In other places the surface layer is thicker and darker.

Permeability is moderate. Surface runoff is slow. Available water capacity is high. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface. Subsurface drains are generally needed to permit timely fieldwork. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility and maintains good tilth.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately well suited to trees if competing vegetation is controlled or removed. Plant competition can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling.

The land capability classification is IIe.

293C—Chelsea-Lamont-Fayette complex, 2 to 9 percent slopes. These gently sloping and moderately sloping, well drained to excessively drained soils are on narrow ridgetops and convex side slopes that commonly border major streams and on convex slopes on high stream benches. Individual areas are irregular in shape and range from 5 to 40 acres in size. They are about 30 percent Chelsea soil, 30 percent Lamont soil, and 30 percent Fayette soil. The three soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Chelsea soil has a surface layer of very dark gray loamy fine sand about 3 inches thick. The subsurface layer is fine sand about 28 inches thick. The upper part is dark grayish brown, and the lower part is brown and yellowish brown. Below this to a depth of about 60 inches is pale brown, loose fine sand that has bands of brown sandy loam ¼ inch to 2 inches thick.

Typically, the Lamont soil has a surface layer of dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is brown fine sandy loam about 8 inches thick. The subsoil is very friable fine sandy loam about 35 inches thick. The upper part is yellowish brown, the next part is brown and dark yellowish brown, and the lower part is strong brown. Below this to a depth of about 60 inches is yellowish brown and brownish yellow loamy sand that has thin bands of brown material.

Typically, the Fayette soil has a surface layer of very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown silt loam that has light brownish gray mottles. In places the surface layer is lighter colored and is mixed with subsoil material.

Permeability is rapid in the Chelsea soil, moderately rapid and rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff is medium on all three soils. 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 ranges from less than 1 percent to about 3 percent in the surface layer of these soils. The subsurface layer of the Chelsea soil generally has a very low supply of available phosphorus and a low supply of available potassium. The subsoil of the Lamont soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Fayette soil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used as woodland, hayland, or previously cultivated pasture. These soils are moderately well suited to corn, soybeans, and small grain. They are better suited to grasses and legumes for hay and pasture. If these soils are used for cultivated crops, they are subject to erosion. The Chelsea and Lamont soils are droughty in most years and subject to wind erosion. Windblown sand grains from these soils can damage newly seeded crops. The surface layer of the Lamont and Fayette soils tends to crust after periods of heavy rainfall and puddle if the soils are worked when wet. As the Chelsea soil dries out, traction of farm machinery is adversely affected by the loose consistence of the soil. A system of conservation tillage that leaves crop residue on the surface helps to control erosion. Terracing is difficult because of the irregular topography and the sandy areas, which have poor stability. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Fayette soil is too wet, however, causes surface compaction, increased runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during extremely wet or dry periods help to keep the pasture in good condition.

These soils are moderately suited to hardwood and coniferous trees. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality is a moderate concern on the sandy Chelsea soil. The soil is droughty, and trees may require supplemental water.

The land capability classification is IIIe.

293D—Chelsea-Lamont-Fayette complex, 9 to 14 percent slopes. These strongly sloping, well drained to excessively drained soils are on narrow ridgetops and convex side slopes that commonly border major streams and on convex slopes on high stream benches. Individual areas are irregular in shape and range from 5 to 20 acres in size. They are about 30 percent Chelsea soil, 30 percent Lamont soil, and 30 percent Fayette soil. The three soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Chelsea soil has a surface layer of very dark gray loamy fine sand about 3 inches thick. The subsurface layer is fine sand about 28 inches thick. The upper part is dark grayish brown, and the lower part is brown and yellowish brown. Below this to a depth of about 60 inches is pale brown, loose fine sand that has bands of brown sandy loam ¼ inch to 2 inches thick.

Typically, the Lamont soil has a surface layer of dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The subsoil is very friable fine sandy loam about 28 inches thick. The upper part is yellowish brown, the next part is brown and dark yellowish brown, and the lower part is strong brown. Below this to a depth of about 60 inches is yellowish brown and brownish yellow loamy sand that has thin bands of brown material.

Typically, the Fayette soil has a surface layer of very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark gray and dark grayish brown silt loam about 6 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is brown silt loam; the next part is yellowish brown silty clay loam; and the lower part is yellowish brown, mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown silt loam that has light brownish gray mottles. In places the surface layer is lighter colored and is mixed with subsoil material.

Permeability is rapid in the Chelsea soil, moderately rapid and rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff is medium or rapid on all three soils. 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 ranges from less than 1 percent to about 3 percent in the surface layer of these soils. The subsurface layer of the Chelsea soil generally has a very low supply of available phosphorus and a low supply of available potassium. The subsoil of the Lamont soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Fayette soil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used as woodland, hayland, or previously cultivated pasture. These soils are poorly suited to corn, soybeans, and small grain. They are better suited to grasses and legumes for hay and pasture. If these soils are used for cultivated crops, they are subject to wind erosion and water erosion. The Chelsea and Lamont soils are droughty in most years. The surface layer of the Lamont and Fayette soils tends to crust after periods of heavy rainfall and puddle if worked when wet. As the Chelsea soil dries out, traction of farm machinery is adversely affected by the loose consistence of the soil. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Contour stripcropping also helps to control erosion. Terracing is difficult because the topography is irregular and the sandy areas are not stable. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility and tilth.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the Fayette soil is too wet, however, causes surface compaction, increased runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during extremely wet or dry periods help to keep the pasture in good condition.

These soils are moderately suited to hardwood and coniferous trees. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality is a moderate concern on the sandy Chelsea soil. The Chelsea and Lamont soils are droughty, and trees may require supplemental water.

The land capability classification is IVe.

293F—Chelsea-Lamont-Fayette complex, 14 to 25 percent slopes. These moderately steep and steep, well drained to excessively drained soils are on very narrow ridgetops and convex side slopes that commonly border major streams. Individual areas are irregular in shape and range from 2 to 10 acres in size. They are about 30 percent Chelsea soil, 30 percent Lamont soil, and 30 percent Fayette soil. The three soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Chelsea soil has a surface layer of very dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is dark grayish brown, brown, and yellowish brown loamy fine sand and fine sand about 20 inches thick. Below this to a depth of about 60 inches is yellowish brown and light yellowish brown, loose fine sand that has many bands of brown sandy loam. In places the surface layer is brown or dark brown loamy fine sand.

Typically, the Lamont soil has a surface layer of dark brown or dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is brown or dark brown fine sandy loam about 4 inches thick. The subsoil is very friable fine sandy loam about 24 inches thick. The upper part is yellowish brown, the next part is brown and dark yellowish brown, and the lower part is strong brown. The substratum to a depth of about 60 inches is yellowish brown and brownish yellow loamy sand that has thin bands of loam and fine sandy loam.

Typically, the Fayette soil has a surface layer of very dark gray silt loam about 3 inches thick. The subsurface layer is dark gray and dark grayish brown silt loam about 4 inches thick. The subsoil is about 35 inches thick. It is friable. The upper part is brown silt loam; the next part is yellowish brown silty clay loam; and the lower part is yellowish brown, mottled silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam that has light brownish gray mottles. In places the surface layer is lighter colored and is mixed with subsoil material.

Permeability is rapid in the Chelsea soil, moderately rapid and rapid in the Lamont soil, and moderate in the Fayette soil. Surface runoff is rapid or very rapid on all three soils. 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 ranges from less than 1 percent to about 3 percent in the surface layer of these soils. The subsurface layer of the Chelsea soil generally has a very low supply of available phosphorus and a low supply of available potassium. The subsoil of the Lamont soil generally has a low supply of available phosphorus and a very low supply of available potassium. The subsoil of the Fayette soil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are used as woodland, hayland, or previously cultivated pasture. These soils are generally unsuited to corn, soybeans, and small grain. They are better suited to grasses and legumes for pasture. If these soils are used for cultivated crops, they are subject to severe erosion. The Chelsea and Lamont soils are droughty and are subject to wind erosion. Good tilth generally can be easily maintained. Regularly adding organic material improves fertility.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the Fayette soil is too wet, however, causes surface compaction and increased runoff. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during extremely wet or dry periods help to keep the pasture in good condition.

These soils are moderately suited to hardwoods and conifers. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality is a moderate concern on the sandy Chelsea soil. The Chelsea and Lamont soils are droughty, and trees may require supplemental water.

The land capability classification is VIIe.

315—Perks-Chaseburg complex, 0 to 2 percent slopes. These nearly level soils are on flood plains. They are frequently flooded. The Perks soil is excessively drained, and the Chaseburg soil is well drained. Individual areas are elongated or irregular in shape and range from 5 to more than 100 acres in size. They are about 55 percent Perks soil and 35 percent Chaseburg soil. The two soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Perks soil has a surface layer of very dark grayish brown sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand. In places the surface layer is loamy sand.

Typically, the Chaseburg soil has a surface layer of dark grayish brown silt loam about 10 inches thick. The substratum to a depth of about 60 inches is multicolored, stratified silt loam.

Included with these soils in mapping are small areas of the poorly drained Coland and moderately well drained Spillville soils. These soils are in slack-water areas on the flood plains. They contain more organic matter than the Chaseburg and Perks soils. Also included are small areas of the very poorly drained Shandep soils in old meander channels and sediment-filled oxbows. These soils have a seasonal high water table and may be ponded during wet periods. Included soils make up less than 10 percent of the unit.

Permeability is moderate in the Chaseburg soil. It is moderately rapid in the upper part of the Perks soil and rapid in the lower part. Surface runoff is slow on both soils. Available water capacity is very high in the Chaseburg soil and very low in the Perks soil. The content of organic matter ranges from 0.5 to 2.0 percent in the surface layer of both soils. The substratum of the Chaseburg soil generally has a low supply of available phosphorus, and that of the Perks soil generally has a very low supply of available phosphorus. Both soils generally have a very low supply of available potassium.

These soils are commonly used for pasture, woodland, or wildlife habitat. They are generally unsuited to corn, soybeans, and small grain and are moderately well suited or poorly suited to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. These soils are subject to flooding during wet periods, especially in early spring, and they are droughty during dry periods. As a result, pasture management is difficult. Proper stocking rates, rotation grazing, deferment of grazing during dry periods, and restricted use during wet periods help to keep the pasture in good condition.

Most areas support hardwood timber. These soils are moderately suited or well suited to trees. Seedlings do not survive well in the sandy Perks soils. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. The soils are well suited to wildlife habitat if the proper plant species are selected and properly managed.

The land capability classification is Vw.

320—Arenzville silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on narrow bottom land, in upland drainageways, and on alluvial fans. It is occasionally flooded. Individual areas commonly are elongated and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The upper substratum is stratified dark grayish brown, brown, and pale brown, friable silt loam about 20 inches thick. Below this is an older buried surface layer of black and very dark gray, friable silt loam about 30 inches thick. The lower substratum to a depth of about 60 inches is dark grayish brown silt loam. In some areas the surface layer is dark brown and very dark grayish brown silt loam. In other areas, commonly those nearest the stream channel, the stratified silty sediments are more than 40 inches deep over the old buried surface layer. In places the lower substratum is silty clay loam.

Permeability is moderate. Surface runoff is slow. Available water capacity is very high. The soil has a seasonal high water table at a depth of 3 to 6 feet. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Some narrow areas are used as permanent pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is susceptible to high-velocity, short-duration flooding during periods of heavy rainfall. The floodwater damages crops in some years. It can be controlled by levees and dikes. Good tilth generally can be easily maintained.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and increases the likelihood of puddling. Rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIw.

350—Waukegan silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is in glacial outwash areas and on stream terraces. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is about 26 inches thick. It is friable. The upper part is dark brown silt loam, the next part is brown silt loam, and the lower part is dark yellowish brown loam. The substratum to a depth of 60 inches is yellowish brown sand that has thin bands of dark yellowish brown and strong brown sandy loam.

Included with this soil in mapping are small areas of Raddle soils. These soils are deeper to the underlying sandy material than the Waukegan soil. They are in positions on the landscape similar to those of the Waukegan soil. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the Waukegan soil and very rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. The content of organic matter is about 3.5 to 4.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It may become droughty if rainfall is below normal. A system of conservation tillage that leaves crop residue on the surface helps to conserve moisture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A few areas of this soil are used for pasture or hayland. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIs.

350B—Waukegan silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is in glacial outwash areas and on stream terraces. Individual areas are irregular in shape and range from about 2 to 5 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is about 24 inches thick. It is friable. The upper part is dark brown silt loam, the next part is brown silt loam, and the lower part is dark yellowish brown loam. The substratum to a depth of about 60 inches is yellowish brown sand that has thin bands of dark yellowish brown and strong brown sandy loam.

Included with this soil in mapping are small areas of Raddle and Waukee soils. Raddle soils are deeper to the underlying sandy material than the Waukegan soil. Waukee soils have a higher content of sand in the surface layer and upper part of the subsoil than the Waukegan soil. Both of these soils are in positions on the landscape similar to those of the Waukegan soil. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the Waukegan soil and very rapid in the lower part. Surface runoff is medium. Available water capacity is moderate. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. The soil may become droughty if rainfall is below normal. A system of conservation tillage that leaves crop residue on the surface helps to reduce excessive soil loss and to conserve moisture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

A few areas of this soil are used for pasture or hayland. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

351—Atterberry silt loam, sandy substratum, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on loess-covered stream terraces. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 34 inches thick. It is friable. The upper part is dark grayish brown silty clay loam; the next part is grayish brown, mottled silty clay loam; and the lower part is mottled strong brown, grayish brown, and yellowish brown sandy loam. The substratum to a depth of about 60 inches is yellowish brown sand. Some fine pebbles are throughout the substratum. In some areas the depth to sandy material is less than 40 inches, and in other small areas it is more than 60 inches.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Available water capacity is high. Surface runoff is slow. The soil has a seasonal high water table at a depth of 2 to 4 feet. The shrink-swell potential is moderate in the subsoil. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. If drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Subsurface drains commonly function well if adequate outlets are available. Tilth generally is good in the surface layer, but this layer tends to crust and puddle if the soil is worked when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility and maintains good tilth.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is I.

352B—Whittier silt loam, 1 to 5 percent slopes. This very gently sloping and gently sloping, well drained soil is on loess-covered stream terraces. Individual areas are round or irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 7 inches thick. The subsoil is about 26 inches thick. It is friable. The upper part is brown silty clay loam, and the lower part is dark yellowish brown loam. The substratum to a depth of about 60 inches is brownish yellow and yellowish brown sand that has thin bands of sandy loam. In places the subsoil is mottled within a depth of 30 inches.

Permeability is moderate in the upper part of the profile and very rapid in the lower part. Available water capacity is moderate. Surface runoff is slow or medium. The shrink-swell potential is moderate in the subsoil. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It may become droughty if rainfall is below normal. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Tilth generally is good in the surface layer, but this layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A few areas of this soil are used for pasture or hayland. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. It is droughty when rainfall is below normal. The droughtiness may cause some problems; however, selection of proper species and good management practices can generally overcome this limitation.

The land capability classification is IIe.

354—Aquolls, ponded. These very poorly drained soils are in shallow depressional areas on uplands and in depressions on bottom land and low stream terraces along major streams and rivers. They are subject to ponding and to frequent flooding. Individual areas are irregular in shape and range from 2 to more than 5 acres in size.

Typically, the surface layer is black silty clay loam or clay loam about 10 inches thick. The subsurface layer is black, very dark gray, or dark gray silty clay loam, clay loam, loam, or sandy loam about 30 inches thick. The substratum to a depth of about 60 inches is very dark gray, dark gray, or gray silty clay loam, loam, sandy loam, or loamy sand.

Included with these soils in mapping are small areas of the very poorly drained, mucky Palms soils. The Palms soils are in landscape positions similar to those of these Aquolls. They make up about 10 percent of the unit.

Permeability generally is moderately slow or very slow in these Aquolls. Available water capacity generally is moderate or high. In most areas the water table is at or near the surface throughout the year. The content of organic matter is commonly more than 15 percent in the surface layer.

Most areas are idle or are used as wildlife habitat. These soils generally are well suited to wetland wildlife habitat but are unsuited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Providing adequate drainage is very difficult because suitable outlets may not be available.

The land capability classification is VIIw.

377B—Dinsdale silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to more than 100 acres in size.

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 silty clay loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, brown, and dark yellowish brown, friable silty clay loam; the next part is dark yellowish brown, mottled, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown and light yellowish brown, mottled loam. A stone line commonly separates the loess from the underlying glacial till.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

377C—Dinsdale silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 20 acres in size.

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 silty clay loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, brown, and dark yellowish brown, friable silty clay loam; the next part is dark yellowish brown, mottled, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown and light yellowish brown, mottled loam. A stone line is commonly between the silty clay loam and the underlying loam glacial till.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

377C2—Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on short, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. It has streaks and pockets of brown and dark yellowish brown subsoil material. The subsoil is about 24 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the next part is dark yellowish brown, mottled, firm loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown and light yellowish brown, mottled loam. A stone line is commonly between the silty clay loam and the underlying loam glacial till.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Dinsdale soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

381B—Klinger-Maxfield complex, 1 to 4 percent slopes. These very gently sloping, somewhat poorly drained and poorly drained soils are on broad divides and in drainageways in the uplands. Individual areas are irregular in shape and range from 2 to 30 acres in size. They are about 60 percent Klinger soil and about 40 percent Maxfield soil. The two soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Klinger soil has a surface layer of black silt loam about 8 inches thick. The subsurface layer is very dark gray silty clay loam about 6 inches thick. The subsoil is about 35 inches thick. The upper part is dark grayish brown, friable silty clay loam; the next part is grayish brown, mottled, friable silty clay loam; and the lower part is mottled grayish brown, light brownish gray, and yellowish brown, firm loam. The substratum to a depth of about 60 inches is mottled light brownish gray and yellowish brown loam.

Typically, the Maxfield soil has a surface layer of black silty clay loam about 9 inches thick. The subsurface layer is black and very dark gray silty clay loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is very dark gray, friable silty clay loam; the next part is grayish brown, mottled, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is mottled light brownish gray, yellowish brown, and strong brown loam in the upper part and light yellowish brown, mottled loam in the lower part. A stone line commonly separates the loess and the underlying glacial till.

Permeability is moderate in the Klinger and Maxfield soils. Surface runoff is slow. Available water capacity is high. The Klinger soil has a seasonal high water table at a depth of 2 to 4 feet, and the Maxfield soil has one at a depth of 1 to 2 feet. The Maxfield soil has a high shrink-swell potential. The content of organic matter is about 4.5 to 5.5 percent in the surface layer of the Klinger soil and 6.0 to 8.0 percent in the surface layer of the Maxfield soil. Both of the soils generally have a very low supply of available phosphorus. The Klinger soil generally has a low supply of available potassium, and the Maxfield soil has a very low supply of available potassium.

Most areas are cultivated. These soils are well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion can be a hazard. A conservation tillage system that leaves crop residue on the surface helps to prevent excessive soil loss. Tile drains are needed in most areas to lower the water table and improve the timeliness of fieldwork. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soils are too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

382—Maxfield silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in broad, shallow drainageways on uplands. Individual areas are irregular in shape and range from 2 to more than 30 acres in size.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black and very dark gray silty clay loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is very dark gray, friable silty clay loam; the next part is grayish brown, mottled, friable silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is loam. It is mottled light brownish gray, yellowish brown, and strong brown in the upper part and light yellowish brown and mottled in the lower part. A stone line separates the loess and the underlying glacial till.

Permeability is moderate. Surface runoff is slow. Available water capacity is high. The soil has a seasonal high water table at a depth of 1 to 2 feet. The shrink-swell potential is high in the upper part of the soil. The content of organic matter is about 6 to 8 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If row crops are grown, a drainage system is needed to lower the water table and improve the timeliness of fieldwork. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

391B—Clyde-Floyd complex, 1 to 4 percent slopes. These very gently sloping, poorly drained and somewhat poorly drained soils are in drainageways on uplands. Individual areas are irregular in shape and range from 5 to 40 acres in size. They are about 55 percent Clyde soil and 45 percent Floyd soil. The two soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Clyde soil has a surface layer of black silty clay loam about 7 inches thick. The subsurface layer is black and very dark gray silty clay loam about 10 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam; the next part is light brownish gray, mottled, friable loam; and the lower part is mottled light brownish gray and yellowish brown, firm loam. The surface soil and the upper part of the subsoil have a high content of sand. The substratum to a depth of about 60 inches is mottled gray and strong brown loam. In places the surface soil is thicker.

Typically, the Floyd soil has a surface layer of black loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown loam about 16 inches thick. The subsoil is about 25 inches thick. In sequence downward, it is dark grayish brown, mottled, friable loam; mottled grayish brown and yellowish brown, friable sandy clay loam; olive brown, mottled, very friable sandy loam; and mottled light brownish gray and strong brown, firm loam. The substratum to a depth of about 60 inches is mottled light brownish gray and strong brown loam. In places the surface layer is thinner and lighter colored.

Permeability is moderate in the Clyde and Floyd soils. Surface runoff is slow. Available water capacity is high. The Clyde soil has a seasonal high water table at a depth of 1.0 to 2.5 feet, and the Floyd soil has one at a depth of 2.0 to 4.0 feet. The content of organic matter is about 6 to 9 percent in the surface layer of the Clyde soil and 5 to 6 percent in the surface layer of the Floyd soil. The subsoil of both soils generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. These soils are well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is generally needed to lower the water table and improve the timeliness of fieldwork. Installing tile is difficult in some areas because of the very friable, water-bearing sandy sediments. If cultivated crops are grown, erosion is a hazard. A conservation tillage system that leaves crop residue on the surface helps to prevent excessive soil loss. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soils are tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

Inadequately drained areas generally are used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

394B—Ostrander loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on long, convex ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to more than 100 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown loam about 11 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, friable loam; the next part is yellowish brown, mottled, friable sandy clay loam; and the lower part is yellowish brown, mottled, firm sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In places the surface layer is loamy sand or sandy loam.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

394C—Ostrander loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is black loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, friable loam; the next part is yellowish brown, mottled, friable sandy clay loam; and the lower part is yellowish brown, mottled, firm sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In places the surface layer is loamy sand or sandy loam.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is moderately well suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and grassed waterways help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

408B—Olin fine sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is black fine sandy loam about 8 inches thick. The subsurface layer is very dark brown and dark brown fine sandy loam about 15 inches thick. The subsoil is about 23 inches thick. The upper part is brown, very friable fine sandy loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown, strong brown, and grayish brown loam. In places a stone line separates the surface sediments from the underlying loam glacial till. In some areas the surface layer is loamy sand. In other areas the depth to loam glacial till is more than 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Kenyon and well drained Ostrander soils. These soils are in landscape positions similar to those of the Olin soil. They have a higher available water capacity than the Olin soil. They make up about 5 percent of the unit. Also included are small areas of the somewhat poorly drained Floyd soils along upland drainageways and small areas of the excessively drained Sparta soils on uplands and stream terraces. Floyd soils contain more clay and less sand in the upper part than the Olin soil and have a higher available water capacity. They make up less than 5 percent of the unit. Sparta soils are lower in content of clay than the Olin soil, have a lower available water capacity, and do not have glacial till within a depth of 60 inches. They make up less than 5 percent of the unit.

Permeability is moderately rapid in the upper part of the Olin soil and moderate in the lower part. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Many small areas are cropped within larger areas of adjacent soils. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, wind erosion and water erosion are a hazard. Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. Good tilth generally can be easily maintained. Because the soil is moderately rapidly permeable in the upper part and moderately permeable in the lower part, sidehill seepage is a problem in some areas and commonly occurs during periods of heavy rainfall. It can generally be controlled by tile drains. The soil is not well suited to terracing because ridging of the moderately coarse textured material is difficult and because the less productive underlying glacial till is too close to the surface. Terrace cuts should not expose the glacial till. Droughtiness is a hazard unless rainfall is timely. Yields are affected by the amount and timeliness of rainfall. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plant cover. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The land capability classification is IIe.

408C—Olin fine sandy loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on short, convex side slopes in the uplands. Individual areas generally are long and narrow and range from 2 to 15 acres in size.

Typically, the surface layer is black or very dark brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is brown, very friable fine sandy loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown, strong brown, and grayish brown loam. In places a stone line separates the surface sediments from the underlying loam glacial till. In some areas the surface layer is loamy sand. In other areas the depth to loam glacial till is more than 40 inches.

Included with this soil in mapping are small areas of the excessively drained Sparta soils. These soils are in landscape positions similar to those of the Olin soil. They do not have loam glacial till within a depth of 60 inches. They make up less than 5 percent of the unit.

Permeability is moderately rapid in the upper part of the Olin soil and moderate in the lower part. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Many small areas are cropped within larger areas of adjacent soils that are better suited to crops. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, wind erosion and water erosion are hazards. Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover. A conservation tillage system that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. Good tilth generally can be easily maintained. Because the soil is moderately rapidly permeable in the upper part and moderately permeable in the lower part, sidehill seepage is a problem in some areas and commonly occurs during periods of heavy rainfall. It can generally be controlled by tile drains. The soil is not well suited to terracing because ridging of the moderately coarse textured material is difficult and because the less productive underlying glacial till is too close to the surface. Terrace cuts should not expose the glacial till. Droughtiness is a hazard unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing and grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plant cover. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The land capability classification is IIIe.

412C—Emeline loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, somewhat excessively drained soil is on ridges and short, convex side slopes in the uplands. Individual areas are irregular in shape or somewhat elongated and range from 2 to 20 acres in size.

Typically, the surface layer is black loam about 9 inches thick. Level-bedded, hard, fragmented limestone bedrock is at a depth of about 9 inches. In places the depth to bedrock is more than 12 inches.

Included with this soil in mapping are small areas of soils that have a surface layer of loamy sand or sand. These soils are lower in organic matter content than the Emeline soil and are more susceptible to wind erosion in unprotected areas. They are in landscape positions similar to those of the Emeline soil. They make up about 5 percent of the unit. Also included are small areas of exposed bedrock, which interferes with tillage. These areas are in landscape positions similar to those of the Emeline soil. They make up about 10 percent of the unit.

Permeability is moderate in the Emeline soil. Surface runoff is medium. Available water capacity is very low. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. This soil generally has a very low supply of available phosphorus and a low supply of available potassium.

Some small areas are cropped within larger areas of adjacent soils that are better suited to crops. This soil is generally unsuited to cultivated crops because of the severe erosion hazard and the shallowness to bedrock. It is better suited to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. Droughtiness is a severe hazard.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is suited to trees. Plant competition is moderate. It can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IVs.

412E—Emeline loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, somewhat excessively drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape or somewhat elongated and range from 2 to 10 acres in size.

Typically, the surface layer is black loam about 9 inches thick. Level-bedded, hard, fragmented limestone bedrock is at a depth of about 9 inches. In places the depth to limestone bedrock is more than 20 inches.

Included with this soil in mapping are small areas of soils that have a loamy sand or sand surface layer. These soils are lower in organic matter content than the Emeline soil and are more susceptible to wind erosion in unprotected areas. They are in landscape positions similar to those of the Emeline soil. They make up about 10 percent of the unit. Also included are small areas of exposed bedrock. These areas are in landscape positions similar to those of the Emeline soil. They make up about 5 percent of the unit.

Permeability is moderate in the Emeline soil. Surface runoff is rapid. Available water capacity is very low. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. This soil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are used as pasture. This soil is generally unsuited to cultivated crops because of the slope, the shallowness to bedrock, and a hazard of droughtiness. Pasture is easily overgrazed on this shallow soil. Overgrazing increases the susceptibility to erosion. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is VIIs.

428B—Ely silty clay loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on slightly concave foot slopes and alluvial fans. Individual areas are commonly long and narrow or irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 11 inches thick. Below this is a transitional layer of very dark gray silty clay loam about 7 inches thick. The subsoil is friable silty clay loam about 25 inches thick. The upper part is grayish brown and mottled; the next part is brown and mottled; and the lower part is mottled brown and light brownish gray. The substratum to a depth of about 60 inches is light brownish gray, mottled silty clay loam. In places the subsoil is dark brown and brown silty clay loam.

Permeability is moderate. Surface runoff is medium.

Available water capacity is high. The soil has a seasonal high water table at a depth of 2 to 4 feet. The content of organic matter is about 5 to 6 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A conservation tillage system that leaves crop residue on the surface, cover crops, and grassed waterways help to prevent excessive soil loss. A subsurface drainage system is needed in most areas to lower the water table and improve the timeliness of fieldwork. In some areas surface runoff from adjacent, more strongly sloping side slopes creates siltation that can hamper crop production. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soil is too wet causes surface compaction, increased runoff, and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIe.

462B—Downs silt loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on high loess-covered benches along streams. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is dark yellowish brown and yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. Coarse sand and gravel commonly are below a depth of 60 inches. In places the surface layer is thicker and is very dark brown.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and stripcropping help to prevent excessive soil loss. In a few areas, slopes are long enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIe.

462C—Downs silt loam, benches, 5 to 9 percent slopes. This moderately sloping, well drained soil is on high loess-covered benches along streams. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown and dark brown silt loam about 4 inches thick. The subsoil is about 34 inches thick. It is friable. The upper part is dark yellowish brown and yellowish brown silty clay loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. Coarse sand and gravel commonly are below a depth of 60 inches. In places the surface layer is thicker and is very dark brown.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

463B—Fayette silt loam, benches, 2 to 5 percent slopes. This gently sloping, well drained soil is on high, loess-covered benches along streams. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 37 inches thick. It is friable. The upper part is yellowish brown silt loam; the next part is yellowish brown silty clay loam; and the lower part is yellowish brown, mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. Coarse sand and gravel are commonly below a depth of about 60 inches. In places the surface layer is dark grayish brown and brown silt loam.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and stripcropping help to prevent excessive soil loss. In a few areas slopes are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIe.

463C—Fayette silt loam, benches, 5 to 9 percent slopes. This moderately sloping, well drained soil is on high, loess-covered benches along streams. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and friable. The upper part is silt loam, the next part is silty clay loam, and the lower part is mottled silty clay loam. The substratum to a depth of about 60 inches is yellowish brown silt loam that has light brownish gray mottles. Coarse sand and gravel commonly are below a depth of about 60 inches. In places the surface layer is dark grayish brown and brown silt loam.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a high supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and stripcropping help to prevent excessive soil loss. In a few areas slopes are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

478G—Nordness-Rock outcrop complex, 18 to 60 percent slopes. This steep and very steep map unit occurs as areas of a shallow, well drained Nordness soil intermingled with areas of Rock outcrop. It is commonly on escarpments and upland side slopes along streams and rivers. The escarpments commonly are 50 to 200 feet high. The precipitous slopes commonly are wooded and are covered by huge masses and blocks of limestone broken off from the higher, adjacent slopes. Individual areas are commonly long and narrow and range from 5 to 20 acres in size. They are about 55 percent Nordness soil and 40 percent Rock outcrop. The Nordness soil and the Rock outcrop occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Nordness soil has a surface layer of very dark grayish brown loam about 2 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is about 9 inches thick. The upper part is mixed brown and very dark grayish brown, friable loam, and the lower part is brown, reddish brown, and yellowish red, friable clay loam. Level-bedded, fragmented limestone is at a depth of about 14 inches. Limestone fragments are common on the surface and are throughout the soil.

Typically, the Rock outcrop is dolomite limestone bedrock. A thin layer of silt loam or loam covers the bedrock in some areas.

Included with this unit in mapping are areas of Dubuque and Winneshiek soils. These soils are commonly on the upper part of the slopes. They make up about 5 percent of the unit.

Permeability is moderate in the Nordness soil. Surface runoff is very rapid. Available water capacity is very low. The shrink-swell potential is high in the subsoil. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are wooded. A few are used as permanent pasture. This map unit is unsuited to cultivated crops and to hay and pasture because of the shallowness to bedrock, the slope, and the Rock outcrop.

This map unit is poorly suited to trees. Seedling mortality may be severe on the Nordness soil because of the slope and the shallowness to bedrock. The limestone is fractured, however, and tree roots can penetrate the rock crevasses. Plant competition can be controlled by proper site preparation or by spraying or cutting. Ordinary equipment cannot be used because of the slope. Special equipment and caution in operating the equipment are needed.

The land capability classification is VIIs.

480C—Orwood silt loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. It is high in content of sand. The subsoil is about 47 inches thick. It is friable. The upper part is brown and dark yellowish brown silt loam, the next part is dark yellowish brown and yellowish brown loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the surface layer is loam, and in other places it is dark grayish brown silt loam.

Included with this soil in mapping are small gently sloping areas that have a slope of less than 5 percent. These areas commonly make up less than 5 percent of the unit.

Permeability is moderate in the Orwood soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss (fig. 9). In some areas

Figure 9.—No-till corn in an area of Orwood silt loam, 5 to 9 percent slopes.

slopes are long enough and uniform enough for terracing and farming on the contour. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

480C2—Orwood silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained soil is on narrow ridges and long, convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. It is high in content of sand. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about

47 inches thick. It is friable. The upper part is brown and dark yellowish brown silt loam, the next part is dark yellowish brown and yellowish brown loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the surface layer is loam. In other places it is thinner and lighter colored.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and stripcropping help to prevent excessive soil loss. In some areas slopes are long enough and uniform enough for terracing and farming on the contour. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Orwood soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

480D—Orwood silt loam, 9 to 14 percent slopes. This strongly sloping, well drained soil is on long, convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. It is high in content of sand. The subsoil is about 47 inches thick. It is friable. The upper part is brown and dark yellowish brown silt loam, the next part is dark yellowish brown and yellowish brown loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the surface layer is loam, and in other places it is dark grayish brown silt loam.

Permeability is moderate. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn that is occasionally grown in rotation with small grain. It also is moderately well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. In many areas slopes are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

480D2—Orwood silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on long, convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. It is high in content of sand. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 47 inches thick. It is friable. The upper part is brown and dark yellowish brown silt loam, the next part is dark yellowish brown and yellowish brown loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the surface layer is loam, and in other places it is thinner and lighter colored.

Permeability is moderate. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn that is occasionally grown in rotation with small grain. It also is moderately well suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. In many areas slopes are long enough and uniform enough for terracing and contour farming. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Orwood soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect new stands of trees if species are selected and managed properly.

The land capability classification is IIIe.

480E—Orwood silt loam, 14 to 18 percent slopes. This moderately steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. It is high in content of sand. The subsoil is about 44 inches thick. It is friable. The upper part is brown and dark yellowish brown silt loam, the next part is dark yellowish brown and yellowish brown loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. In places the surface layer is loam.

Permeability is moderate. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated or are used for pasture. This soil is poorly suited to corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways can help to prevent excessive soil loss. In most areas slopes are too short and too steep for terracing, but some areas can be terraced along with the less sloping soils upslope. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous.

The land capability classification is IVe.

480E2—Orwood silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. It is high in content of sand. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 40 inches thick. It is friable. The upper part is brown and dark yellowish brown silt loam, the next part is dark yellowish brown and yellowish brown loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the surface layer is loam. In other places it is thinner and lighter colored.

Permeability is moderate. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Some are used for pasture. This soil is poorly suited to corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. In most areas slopes are too short and too steep for terracing, but some areas can be terraced along with the less sloping soils upslope. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Orwood soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous.

The land capability classification is IVe.

480F2—Orwood silt loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. It is high in content of sand. It has brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is about 38 inches thick. It is friable. The upper part is brown and yellowish brown silt loam, the next part is dark yellowish brown and yellowish brown loam, and the lower part is yellowish brown silt loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some places the surface layer is loam, and in other places it is thinner and lighter colored.

Permeability is moderate. Surface runoff is very rapid in cultivated areas. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil has a low supply of available phosphorus and a very low supply of available potassium.

Some areas are cultivated, and some are used for pasture. This soil is generally unsuited to corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. In most areas slopes are too short and too steep for terracing. Good tilth generally can be easily maintained.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is VIe.

484—Lawson silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flood plains along rivers and streams. It is occasionally flooded. Individual areas are elongated or irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is black and very dark gray silt loam about 24 inches thick. The substratum to a depth of about 60 inches is very dark gray, very dark grayish brown, and dark grayish brown, mottled silt loam. In some places the content of sand is higher. In other places the surface soil is more than 32 inches thick.

Included with this soil in mapping are small areas of the poorly drained Colo soils. These soils make up about 5 percent of the unit.

Permeability is moderate in the Lawson soil. Surface runoff is slow. Available water capacity is high. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 4.5 to 6.0 percent in the surface layer. This soil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated or are used for hay and pasture. Some small areas support trees. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Cultivated crops can be grown in most years. The flooding generally is brief. In many places diversion terraces on adjacent foot slopes help to control the runoff from the higher areas. Tile drainage may be needed to help lower the water table and improve the timeliness of fieldwork. Good tilth generally can be easily maintained. Returning crop residue to the soil and delaying fieldwork when the soil is wet help to prevent deterioration of tilth and improve fertility.

A cover of pasture plants or hay is effective in controlling erosion. Pasture management is difficult, however, in the flooded areas. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods or following periods of flooding help to keep the pasture in good condition. Permanent pasture can be improved by renovating and reseeding.

A few areas support native hardwoods. This soil is suited to trees. Because this soil is somewhat poorly drained, equipment use generally is restricted to the drier times of the year or to winter when the ground is frozen. Seedlings survive and grow well on this soil. Competing vegetation can be controlled by proper site preparation or by spraying or cutting.

The land capability classification is IIw.

485—Spillville loam, 0 to 2 percent slopes. This nearly level, moderately well drained or somewhat poorly drained soil is on bottom land. It is occasionally flooded. Individual areas are irregular in shape and range from 2 to 45 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is black, very dark brown, and very dark grayish brown loam about 44 inches thick. The substratum to a depth of about 60 inches is dark brown loam. In some areas the surface soil is thinner.

Included with this soil in mapping are some small areas of soils that have a sandy loam surface layer. These soils are lower in organic matter content than the Spillville soil and have a lower available water capacity. They are in landscape positions similar to those of the Spillville soil or are in the slightly higher areas. They make up less than 5 percent of the unit.

Permeability is moderate in the Spillville soil. Surface runoff is slow. Available water capacity is high. The soil has a seasonal high water table at a depth of 3 to 5 feet. The content of organic matter is about 4 to 5 percent in the surface layer. This soil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A subsurface drainage system is needed in some areas to reduce the wetness and improve the timeliness of fieldwork. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Some areas are used for pasture and hay. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

489—Ossian silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on low stream terraces and bottom land. It is occasionally flooded. Individual areas are irregular in shape and range from 2 to 80 acres or more in size.

Typically, the surface layer is black silt loam about 6 inches thick. The subsurface layer is black silt loam about 8 inches thick. Below this is a transitional layer of very dark gray and very dark grayish brown silt loam about 3 inches thick. The subsoil is friable, mottled silt loam about 30 inches thick. The upper part is olive gray, and the lower part is light olive gray. The substratum to a depth of about 60 inches is light olive gray and mottled dark yellowish brown, yellowish brown, and light olive gray silty clay loam. In some places the subsoil is dark grayish brown and grayish brown silt loam. In other places the surface layer is thicker and less gray.

Permeability is moderate. Surface runoff is slow. Available water capacity is very high. The soil has a seasonal high water table at a depth of 1 to 2 feet. The content of organic matter is about 5 to 7 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and improve the timeliness of fieldwork. Tile drains work well if they are properly installed and if an adequate outlet is available. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

A few areas are used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIw.

499D—Nordness loam, 5 to 14 percent slopes. This moderately sloping and strongly sloping, well drained soil is on short, convex side slopes in the uplands. Individual areas commonly are long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 2 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is about 9 inches thick. It is friable. The upper part is mixed brown and very dark grayish brown loam, and the lower part is brown and reddish brown silty clay loam. Level-bedded, fragmented limestone bedrock is at a depth of about 14 inches. In places the depth to bedrock is more than 20 inches.

Permeability is moderate. Surface runoff is medium or rapid. Available water capacity is very low. The shrink-swell potential is high in the subsoil. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Some areas are cultivated. This soil is generally unsuited to corn, soybeans, and small grain but is moderately well suited to grasses and legumes for hay and pasture. Droughtiness is a severe hazard. Also, if cultivated crops are grown, erosion is a hazard. Good tilth generally is easily maintained. Tillage is difficult, however, because the soil is shallow over bedrock and limestone slabs are common at the surface. Regular additions of organic material to the surface layer improve fertility and increase the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth, increases the runoff rate, and damages the plant cover. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Most areas support hardwood timber. This soil is not well suited to trees. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is VIs.

499F—Nordness loam, 14 to 30 percent slopes. This moderately steep to very steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are commonly long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 2 inches thick. The subsurface layer is dark grayish brown loam about 2 inches thick. The subsoil is about 8 inches thick. It is friable. The upper part is mixed brown and very dark grayish brown loam, and the lower part is brown and reddish brown silty clay loam. Level-bedded, fragmented limestone bedrock is at a depth of about 14 inches. In places the depth to bedrock is more than 20 inches.

Included with this soil in mapping are areas of Chelsea soils. These soils are in landscape positions similar to those of the Nordness soil. They are slightly lower in organic matter content than the Nordness soil and do not have limestone bedrock within a depth of 60 inches. They make up less than 5 percent of the unit.

Permeability is moderate in the Nordness soil. Surface runoff is rapid or very rapid. Available water capacity is very low. The shrink-swell potential is high in the subsoil. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and a low supply of available potassium.

Most areas are used for trees or as wildlife habitat. Some small areas are used as permanent pasture. This soil is generally unsuited to cultivated crops because of the slope and a severe hazard of erosion. It is extremely limited as a site for other farm uses. Renovating pasture is difficult because of the shallowness to bedrock. Ordinary farm machinery cannot be used because limestone slabs are common at the surface and slopes generally are too steep. The number of livestock that can graze the pasture without damaging the plant cover is limited. As a result, controlled grazing is needed.

Most areas support hardwood timber. This soil is poorly suited to trees. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Special equipment and caution in operating the equipment are needed.

The land capability classification is VIIs.

539—Perks sandy loam, 0 to 2 percent slopes. This nearly level, excessively drained soil is on flood plains. It is frequently flooded. Individual areas are irregular in shape and range from 2 to more than 10 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand. In places the surface layer is loamy sand.

Included with these soils in mapping are small areas of the moderately well drained Chaseburg soils. These soils are in landscape positions similar to those of the Perks soil. They contain more silt and clay than the Perks soil. They make up less than 10 percent of the unit.

Permeability is rapid in the Perks soil. Surface runoff is slow. Available water capacity is very low. The substratum generally has a very low supply of available phosphorus and potassium.

Most areas are used for pasture, woodland, or wildlife habitat. This soil is poorly suited to corn, soybeans, and small grain and is moderately well suited or poorly suited to grasses and legumes for hay and pasture. This soil is subject to flooding during wet periods, especially in early spring, and it is droughty during dry periods. As a result, crop and pasture management is difficult. If cultivated crops are grown, wind erosion is a hazard. Proper stocking rates, rotation grazing, deferment of grazing during dry periods, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees. The soil is well suited to wildlife habitat if plant species are selected carefully and managed properly.

The land capability classification is Vw.

585—Spillville-Coland complex, 0 to 2 percent slopes. These nearly level, moderately well drained to poorly drained soils are on flood plains and bottom land along intermittent streams. They are occasionally flooded. Individual areas are irregular in shape and range from 5 to 40 acres in size. They are about 65 percent Spillville soil and 35 percent Coland soil. The two soils occur as areas so intricately mixed or so small that mapping them separately was not practical.

Typically, the Spillville soil has a surface layer of black loam about 8 inches thick. The subsurface layer is black, very dark brown, and very dark grayish brown loam about 44 inches thick. The substratum to a depth of about 60 inches is dark brown loam. In some areas the surface soil is thinner.

Typically, the Coland soil has a surface layer of black clay loam about 6 inches thick. The subsurface layer is black clay loam about 27 inches thick. Below this is a transitional layer of very dark gray clay loam about 7 inches thick. The upper part of the substratum is dark gray clay loam. The lower part to a depth of about 60 inches is mottled light brownish gray and dark gray sandy clay loam.

Permeability is moderate in the Spillville and Coland soils. Surface runoff is slow. Available water capacity is high. The Spillville soil has a seasonal high water table at a depth of 3 to 5 feet, and the Coland soil has one at a depth of 1 to 3 feet. The content of organic matter ranges from 4 to 7 percent in the surface layer of these soils. The lower part of the subsurface layer in the Spillville soil generally has a very low supply of available phosphorus and potassium. The subsurface layer of the Coland soil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. These soils are well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Cultivated crops can be grown in most years. The flooding generally is brief. Cultivation may be delayed unless the poorly drained Coland soil is drained. Subsurface drains work well if adequate outlets are available. Good tilth generally can be easily maintained, but the surface layer of these soils tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil, regularly adding other organic material to the plow layer, and delaying fieldwork when the soils are wet improve fertility, maintain good tilth, and improve infiltration of water.

If these soils are used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soils are wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIw.

626—Hayfield loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream terraces. Individual areas are irregular in shape and range from 2 to more than 100 acres in size.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is friable loam about 22 inches thick. The upper part is dark grayish brown and grayish brown, and the lower part is brown and mottled. Below this to a depth of about 60 inches is brown, mottled sand that has bands of dark grayish brown sandy loam.

Included with this soil in mapping are small areas of the poorly drained Marshan soils. These soils are in landscape positions similar to those of the Hayfield soil. They make up less than 10 percent of the unit.

Permeability is moderate in the upper part of the Hayfield soil and very rapid in the substratum. Surface runoff is slow. Available water capacity is moderate. The soil has a seasonal high water table at a depth of 2.5 to 5.0 feet. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Droughtiness is a hazard during periods of below normal rainfall. The water table is moderately high in the spring but drops rapidly during the growing season. In some areas tile drainage is beneficial during wet periods, but installing drainage tile is difficult because of the loose, water-bearing sand and gravel. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay improves soil aeration and tilth. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIs.

673D2—Timula silt loam, 5 to 14 percent slopes, moderately eroded. This moderately sloping and strongly sloping, well drained soil is on convex, narrow ridgetops and side slopes in the uplands. Individual areas are long and narrow or irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is brown silt loam about 5 inches thick. It commonly has yellowish brown streaks and pockets of subsoil material. The subsoil is friable or very friable yellowish brown silt loam about 25 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam. The entire profile is high in content of coarse silt. In some areas calcium carbonate concretions are throughout the profile. In other areas the surface layer is thinner.

Permeability is moderate. Surface runoff is medium or rapid. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, terraces, and contour farming help to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. The high content of calcium carbonate may restrict the availability of phosphorus and potassium to plants.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some small areas support hardwood timber. This soil is well suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. Seedling mortality and the hazards or limitations that affect planting or harvesting are slight.

The land capability classification is IIIe.

673E2—Timula silt loam, 14 to 20 percent slopes, moderately eroded. This moderately steep and steep, well drained soil is on convex, narrow ridgetops and side slopes in the uplands. Individual areas are long and narrow or irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is brown silt loam about 5 inches thick. It commonly has yellowish brown streaks and pockets of subsoil material. The subsoil is yellowish brown, friable and very friable silt loam about 25 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam. The entire profile is high in content of coarse silt. In some areas calcium carbonate concretions are throughout the profile. In other areas the surface layer is thinner.

Included with this soil in mapping are a few small areas of soils that have a loamy sand or sand surface layer. These soils are slightly lower in organic matter content than the Timula soil and have a lower available water capacity. They are in positions on the landscape similar to those of the Timula soil. They make up less than 5 percent of the unit.

Permeability is moderate in the Timula soil. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Some areas are cultivated. This soil generally is unsuitable for cultivated crops because of the slope and a severe hazard of erosion. It is moderately well suited to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. Regularly adding organic material to the surface improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. The high content of calcium carbonate may restrict the availability of phosphorus and potassium to plants.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Some areas support hardwood timber. This soil is well suited to trees. Special equipment is needed because of the slope. Competing vegetation can be controlled by proper site preparation, prescribed burning, or spraying, cutting, or girdling. Seedling mortality and the hazards or limitations that affect planting or harvesting are moderate.

The land capability classification is IVe.

703D—Dubuque silt loam, 5 to 14 percent slopes. This moderately sloping and strongly sloping, well drained soil is on narrow ridges and on short, convex side slopes in the uplands. Individual areas are elongated and range from 2 to 10 acres in size.

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 8 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, friable silty clay loam; and the lower part is brown, very firm silty clay. Hard, fragmented limestone bedrock is at a depth of about 38 inches. In some places the surface layer is dark grayish brown silt loam, and in other places it is thicker. In some areas the subsoil does not have a layer of silty clay.

Included with this soil in mapping are small areas of Nordness soils on the lower part of side slopes. These soils are 8 to 20 inches deep over limestone bedrock. They make up less than 5 percent of the unit.

Permeability is moderate in the Dubuque soil. Surface runoff is medium or rapid. Available water capacity is moderate. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are wooded or are used as permanent pasture. This soil is moderately well suited to cultivated crops. If cultivated crops are grown, however, erosion is a hazard. Soil loss through erosion adversely affects cropping by decreasing the depth to limestone. Droughtiness is likely to damage crops unless rainfall is timely during the growing season. A system of conservation tillage that leaves crop residue on the surface, stripcropping, and grassed waterways help to prevent excessive soil loss and conserve moisture. The soil is not well suited to terracing because the bedrock may interfere with construction. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IVe.

703F—Dubuque silt loam, 14 to 25 percent slopes. This moderately steep and steep, well drained soil is on short, convex side slopes in the uplands. Individual areas are commonly elongated and range from 2 to 20 acres in size.

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 8 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, friable silty clay loam; and the lower part is brown, very firm silty clay. Hard, fragmented limestone bedrock is at a depth of about 38 inches. In some places the surface layer is dark grayish brown and brown silt loam, and in other places it is thicker. In some areas the subsoil does not have a layer of silty clay.

Included with this soil in mapping are small areas of Nordness soils on the lower part of side slopes. These soils are 8 to 20 inches deep over limestone bedrock. They make up about 10 percent of the unit.

Permeability is moderate in the Dubuque soil. Surface runoff is rapid or very rapid. Available water capacity is moderate. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are wooded or are used as permanent pasture. This soil generally is unsuitable for cultivated crops because of the slope and a severe hazard of erosion. It is poorly suited to pasture. Tilth generally is fair. Grazing should be limited.

Many areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous.

The land capability classification is VIIe.

760—Ansgar silt loam, 0 to 1 percent slopes. This level or slightly depressional, poorly drained soil is on broad upland divides. Individual areas are round or elongated and range from 2 to 10 acres in size.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is silt loam about 8 inches thick. It is dark grayish brown in the upper part, and it is grayish brown and has yellowish brown mottles in the lower part. The subsoil is about 30 inches thick. It is grayish brown, friable silty clay loam in the upper part; mottled grayish brown, dark grayish brown, and strong brown, firm loam in the next part; and mottled yellowish brown, light olive gray, dark grayish brown, and yellowish red, firm loam in the lower part. The substratum to a depth of about 60 inches is light olive brown, mottled loam. In places the surface layer is thicker.

Included with this soil in mapping are some small areas of the somewhat poorly drained Franklin soils. These soils have a lower seasonal high water table than the Ansgar soil. Also, they are typically less depressional. They make up about 5 percent of the unit. Also included are some soils that have a friable sandy loam and sandy subsoil above a firm loam substratum. They make up about 15 percent of the unit.

Permeability is moderate in the Ansgar soil. Surface runoff is very slow. Water may pond in depressions for a very short period. The soil has a seasonal high water table at a depth of 1 to 2 feet. Available water capacity is high. The shrink-swell potential is high in the upper part of the subsoil. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil is generally very low in available phosphorus and potassium.

Most areas are cultivated. A few small areas support water-tolerant vegetation. If this soil is drained, it is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Subsurface drains commonly function well if adequate outlets are available. Tilth generally is good in the surface layer, but this layer tends to crust or puddle if the soil is worked when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth. The soil is subject to wind erosion. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when this soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

The land capability classification is IIw.

761B—Franklin silt loam, 1 to 4 percent slopes. This very gently sloping and gently sloping, somewhat poorly drained soil is on upland divides and slightly convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 27 inches thick. It is mottled and friable. The upper part is brown silt loam, the next part is grayish brown silty clay loam, and the lower part is light brownish gray sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. A stone line commonly separates the loess from the underlying firm glacial till.

Permeability is moderate. Surface runoff is slow or medium. Available water capacity is high. This soil has a seasonal high water table at a depth of 2 to 4 feet. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. In some areas tile drainage is needed to reduce the wetness and improve the timeliness of fieldwork. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIe.

763D2—Exette silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained soil is on short, convex side slopes in the uplands and in slightly concave coves along upland drainageways. Individual areas are elongated and range from 2 to 15 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. It has yellowish brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is friable silt loam about 26 inches thick. In sequence downward, it is brown; yellowish brown and mottled; mottled light brownish gray, brown, and yellowish brown; and light brownish gray and mottled. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam that has large, yellowish red accumulations of iron. In some places the upper part of the subsoil is grayish brown throughout. In other places the substratum is loam. In some areas the soil has no mottles within a depth of 30 inches.

Included with this soil in mapping are small areas of Downs soils. These soils have a thicker surface layer than the Exette soil and do not have mottles within a depth of 30 inches. They are commonly upslope from the Exette soil. They make up about 10 percent of the unit.

Permeability is moderate in the Exette soil. Surface runoff is medium or rapid. Available water capacity is very high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Some are used for pasture. This soil is moderately well suited to occasional row crops that are grown in rotation with small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and grassed waterways help to prevent excessive soil loss. The soil is not well suited to terracing because the slopes are short and complex and because the subsoil is very erodible if it is exposed by deep cuts. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

763E2—Exette silt loam, 14 to 18 percent slopes, moderately eroded. This moderately steep, well drained soil is in slightly concave coves along upland drainageways and on short, convex side slopes in the uplands. Individual areas are elongated and range from 2 to 15 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. It has yellowish brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is friable silt loam about 24 inches thick. In sequence downward, it is brown; yellowish brown and mottled; mottled light brownish gray, brown, and yellowish brown; and light brownish gray and mottled. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam that has large, yellowish red accumulations of iron. In some places the substratum is yellowish brown loam. In other places the soil has no mottles within a depth of 30 inches.

Permeability is moderate. Surface runoff is rapid. Available water capacity is very high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used for pasture or woodland. This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to prevent excessive soil loss. The soil generally is not suitable for terracing because the slopes are too steep and are short and complex.

Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in fairly good condition.

Some areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Seedlings survive and grow well on this soil.

The land capability classification is IVe.

763F2—Exette silt loam, 18 to 25 percent slopes, moderately eroded. This steep, well drained soil is in slightly concave coves along upland drainageways and on short, convex side slopes that are dissected by many small drainageways. Individual areas are elongated and range from 2 to 10 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. It has yellowish brown streaks and pockets of subsoil material. Plowing has mixed the upper part of the subsoil with the surface layer. The subsoil is friable silt loam about 22 inches thick. In sequence downward, it is brown; yellowish brown and mottled; mottled light brownish gray and yellowish brown; and brownish gray and mottled. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam that has large, yellowish red accumulations of iron. In some places the substratum is yellowish brown loam. In other places the surface layer is dark grayish brown. In some small areas the soil has no mottles within a depth of 30 inches.

Permeability is moderate. Surface runoff is very rapid in cultivated areas. Available water capacity is very high. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Many areas are cultivated. Some are used for pasture. This soil generally is unsuited to cultivated crops and is only moderately well suited to hay. Further erosion is a severe hazard. Operating farm machinery is difficult because of the slope and the many small drainageways. Cultivated crops should be grown only to help when reestablishing hay and pasture. Tilth generally is fair in the surface layer.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in fairly good condition.

Some small areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Seedlings survive and grow well on this soil.

The land capability classification is VIe.

771B—Waubeek silt loam, 2 to 5 percent slopes. This gently sloping, well drained and moderately well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is mixed dark grayish brown and dark brown silt loam about 3 inches thick. The subsoil is about 32 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled loam. A stone line commonly separates the loess from the underlying glacial till. In some places the surface layer is thinner, and in other places it is high in content of sand.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support mixed grasses and hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIe.

771C—Waubeek silt loam, 5 to 9 percent slopes. This moderately sloping, well drained and moderately well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is mixed dark grayish brown, dark brown, and very dark grayish brown silt loam about 3 inches thick. The subsoil is about 32 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is dark yellowish brown loam. A stone line commonly separates the loess from the underlying glacial till. In some places the surface layer is thinner or thicker, and in other places it is high in content of sand.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to intensively grown corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases runoff. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support mixed grasses and hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

771C2—Waubeek silt loam, 5 to 9 percent slopes, moderately eroded. This moderately sloping, well drained and moderately well drained soil is on narrow, convex ridges and side slopes in the uplands. Individual areas are irregular in shape or long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. It has dark grayish brown, yellowish brown, and brown streaks and pockets of subsoil material. The subsoil is about 34 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is dark yellowish brown loam. A stone line commonly separates the loess from the underlying glacial till. In some places the surface layer is thinner, and in other places it is high in content of sand.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and terraces help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Waubeek soils.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support mixed grasses and hardwood timber. This soil is well suited to trees. Laying out logging trails and roads on the contour helps to control erosion. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

771D—Waubeek silt loam, 9 to 14 percent slopes. This strongly sloping, well drained and moderately well drained soil is on convex side slopes in the uplands. Individual areas are long and narrow and range from 2 to 5 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is mixed dark grayish brown, dark brown, and very dark grayish brown silt loam about 3 inches thick. The subsoil is about 30 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of 60 inches is dark yellowish brown loam. A stone line commonly separates the loess from the underlying glacial till. In places the surface layer is thinner.

Permeability is moderate. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn and soybeans. It is well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and either terraces or contour stripcropping help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases runoff. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support mixed grasses and hardwood timber. This soil is well suited to trees. The slope may create problems during harvest. Logging trails and roads should be established on the contour to help control erosion.

The land capability classification is IIIe.

771D2—Waubeek silt loam, 9 to 14 percent slopes, moderately eroded. This strongly sloping, well drained and moderately well drained soil is on convex side slopes in the uplands. Individual areas are long and narrow and range from 2 to 5 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. It has dark grayish brown, yellowish brown, and brown streaks and pockets of subsoil material. The subsoil is about 32 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the next part is yellowish brown, friable loam; and the lower part is yellowish brown, firm loam. A stone line commonly separates the loess from the underlying glacial till. In places the surface layer is thinner.

Permeability is moderate. Surface runoff is rapid. Available water capacity is high. The content of organic matter is about 2 to 3 percent in the surface layer. The subsoil generally has a medium supply of available phosphorous and a very low supply of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and either terraces or contour stripcropping help to prevent excessive soil loss. Terrace cuts should not expose the less productive underlying glacial till. Tilth generally is fair in the surface layer. This layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. More nitrogen and more intensive management are needed on this soil than on the less eroded Waubeek soils.

A cover of pasture plants or hay may be effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth and increases runoff. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

A few small areas support mixed grasses and hardwood timber. This soil is well suited to trees. The slope may create problems during harvest. Logging trails and roads should be established on the contour to help control erosion.

The capability classification is IIIe.

775B—Billett sandy loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream terraces and in the uplands. Individual areas are long and narrow and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 37 inches thick. It is very friable. The upper part is dark yellowish brown sandy loam, and the lower part is dark yellowish brown and brown gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown sand. Chert and glacial pebbles commonly are throughout the profile. In some places the surface layer is loamy sand or very dark grayish brown sandy loam. In other places it is thicker and darker.

Permeability is moderately rapid. Surface runoff is slow. Available water capacity is low or moderate. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Some small areas are cropped within larger areas of adjacent soils that are better suited to crops. This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. Droughtiness is a severe hazard in most years unless rainfall is timely. Wind erosion is a hazard if cultivated crops are grown. Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover. A system of conservation tillage that leaves crop residue on the surface and cover crops help to prevent excessive soil loss. Tilth generally is fair in the surface layer. The soil warms up quickly in the spring, thus stimulating early plant growth. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the available water capacity.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

Most areas of trees are limited to groves in or near farmsteads. This soil is moderately well suited to trees. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is IIIs.

775D—Billett sandy loam, 5 to 14 percent slopes. This gently sloping to strongly sloping, well drained soil is on stream terraces and in the uplands. Individual areas are long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 35 inches thick. It is very friable. The upper part is dark yellowish brown sandy loam, and the lower part is dark yellowish brown and brown gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown sand. Chert and glacial pebbles commonly are throughout the profile. In some places the surface layer is loamy sand or very dark grayish brown sandy loam. In other places it is thicker and darker.

Permeability is moderately rapid. The content of organic matter is about 1 to 2 percent in the surface layer. Surface runoff is medium. Available water capacity is low. The subsoil generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Some small areas are cropped within larger areas of adjacent soils that are better suited to crops. This soil generally is unsuitable for corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. Droughtiness is a severe hazard in most years unless rainfall is timely. Wind erosion is a hazard if cultivated crops are grown. Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover. Tilth generally is fair in the surface layer. The soil warms up quickly in the spring, thus stimulating early plant growth. Regularly adding organic material improves fertility, increases the available water capacity, and helps to prevent excessive soil loss.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

A few areas support hardwood timber. This soil is moderately suited to trees. Carefully selecting sites for logging trails and roads helps to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is IIIs.

775E—Billett sandy loam, 14 to 20 percent slopes. This strongly sloping to steep, well drained soil is on stream terraces and in the uplands. Individual areas are long and narrow and range from 2 to 10 acres in size.

Typically, the surface layer is brown and dark brown sandy loam about 6 inches thick. The subsoil is about 32 inches thick. It is very friable. The upper part is dark yellowish brown sandy loam, and the lower part is dark yellowish brown and brown gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown sand. Chert and glacial pebbles are commonly throughout the profile. In some places the surface layer is loamy sand or dark grayish brown sandy loam. In other places it is thinner.

Permeability is moderately rapid. Surface runoff is medium or rapid. Available water capacity is low. The content of organic matter is about 1 to 2 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Some areas are cultivated. Some small areas are cropped within larger areas of adjacent soils that are better suited to crops. This soil generally is unsuited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. Droughtiness is a severe hazard in most years unless rainfall is timely. Wind erosion is a hazard if cultivated crops are grown. Windblown sand grains can damage newly seeded crops on this soil and on the adjacent soils unless the surface is protected by a plant cover.

Tilth generally is fair in the surface layer. The soil warms up quickly in the spring, thus stimulating early plant growth. Regularly adding organic material improves fertility, increases the available water capacity, and helps to prevent excessive soil loss.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, reduces the extent of the plant cover and causes deterioration of the plant community. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

A few areas support hardwood timber. This soil is moderately suited to trees. Carefully selecting sites for logging trails and roads helps to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings do not survive well. As a result, a large number of seedlings should be planted at close intervals. Thinning the stand helps to provide adequate growing space for the surviving trees.

The land capability classification is IVs.

778—Sattre loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown loam about 5 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 30 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown. The upper part is loamy sand, and the lower part is sand.

Permeability is moderate in the upper part of the profile and very rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are in pasture or woodland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration. Droughtiness is a hazard unless rainfall is timely.

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

A few areas support hardwood timber. This soil is moderately suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling.

The land capability classification is IIs.

778B—Sattre loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown loam about 5 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 30 inches thick. The upper part is brown, friable loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown. The upper part is loamy sand, and the lower part is sand.

Included with this soil in mapping are a few areas of soils that have steeper slopes. These soils are subject to more erosion than the Sattre soil and have a higher runoff rate. They make up less than 5 percent of the unit.

Permeability is moderate in the upper part of the Sattre soil and very rapid in the lower part. Surface runoff is medium. Available water capacity is moderate. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are in pasture or woodland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Terraces also help to control erosion. The terrace cuts should not expose the less productive coarse textured material in the lower part of the subsoil and in the substratum. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, increases the rate of water infiltration, and conserves soil moisture.

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

A few areas support hardwood timber. This soil is moderately suited to trees. Competing vegetation can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling.

The land capability classification is IIe.

809B—Bertram fine sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat excessively drained soil is on ridges and side slopes in the uplands. Individual areas are long and narrow or irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 8 inches thick. The subsurface layer also is very dark brown fine sandy loam about 8 inches thick. The subsoil is about 18 inches thick. The upper part is dark brown, very friable fine sandy loam, and the lower part is dark yellowish brown, friable sandy clay loam. The substratum is dark yellowish brown sandy clay loam about 5 inches thick. Hard, fractured limestone bedrock is at a depth of about 39 inches. In some places the surface layer is thinner, and in other places it is loamy fine sand.

Permeability is moderately rapid. Surface runoff is medium. Available water capacity is low. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. A few areas are used for hay and pasture. This soil is poorly suited to intensively grown corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. It is droughty. If this soil is used for cultivated crops, it is subject to wind erosion and water erosion. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves soil moisture. This soil is not well suited to terracing because of the moderately coarse textured material and the depth to bedrock. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The land capability classification is IVs.

809C—Bertram fine sandy loam, 5 to 9 percent slopes. This moderately sloping, somewhat excessively drained soil is on narrow, convex ridges and side slopes in the uplands. Individual areas are long and narrow or irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 8 inches thick. The subsurface layer is very dark brown or dark brown fine sandy loam about 6 inches thick. The subsoil is about 15 inches thick. The upper part is dark brown, very friable fine sandy loam, and the lower part is dark yellowish brown, friable sandy clay loam. The substratum is dark yellowish brown sandy clay loam about 5 inches thick. Hard, fractured limestone bedrock is at a depth of about 34 inches. In some places the surface layer is thinner, and in other places it is loamy fine sand.

Permeability is moderately rapid. Surface runoff is medium. Available water capacity is low. The content of organic matter is about 1.5 to 2.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. A few areas are used for hay and pasture. This soil is poorly suited to intensively grown corn, soybeans, and small grain. It is better suited to grasses and legumes for hay and pasture. It is droughty. If this soil is used for cultivated crops, it is subject to wind erosion and water erosion. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves soil moisture. The soil is not well suited to terracing because of the moderately coarse textured material and the depth to bedrock. Tilth generally is fair in the surface layer. Returning crop residue to the soil or regularly adding other organic material improves fertility.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet or dry periods help to keep the pasture in good condition.

The land capability classification is IVs.

814B—Rockton loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark brown loam about 10 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is about 17 inches thick. It is friable. The upper part is brown loam, and the lower part is dark yellowish brown clay loam. Hard, fractured limestone bedrock is at a depth of about 32 inches. In places the depth to bedrock is more than 40 inches.

Permeability is moderate. Surface runoff is medium. Available water capacity is moderate. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is subject to erosion and may be droughty unless rainfall is timely. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves moisture. Constructing terraces is difficult in some areas because of the limited depth to bedrock. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material increases the rate of water infiltration and improves fertility.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

814C—Rockton loam, 5 to 9 percent slopes. This moderately sloping, well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark brown loam about 10 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is about 12 inches thick. It is friable. The upper part is brown loam, and the lower part is dark yellowish brown clay loam. Hard, fractured limestone bedrock is at a depth of about 26 inches. In places the depth to bedrock is more than 40 inches.

Permeability is moderate. Surface runoff is medium. Available water capacity is moderate. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are cultivated. Some are in pasture. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is subject to erosion. It may be droughty in years of average or below average rainfall. The root zone is limited by the depth to bedrock. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves moisture. The soil is not well suited to terracing because of the limited depth to bedrock. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material increases the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIIe.

817C—Ripon silt loam, 2 to 7 percent slopes. This gently sloping and moderately sloping, well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 13 inches thick. It is brown. The upper part is friable silty clay loam, and the lower part is firm clay loam. Hard, fractured limestone bedrock is at a depth of about 30 inches. In places the surface layer and the upper part of the subsoil contain more sand.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The shrink-swell potential is moderate in the lower part of the subsoil. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It may be droughty during periods of below normal rainfall. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves soil moisture. This soil is not well suited to terracing because of the depth to bedrock. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent soil crusting, and increases the water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet or too dry, however, causes surface compaction, poor tilth, and excessive damage to the plants. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

914C—Winneshiek loam, 2 to 9 percent slopes. This gently sloping and moderately sloping, well drained soil is on ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is about 27 inches thick. In sequence downward, it is brown and very dark grayish brown, friable loam; brown, friable loam; dark yellowish brown, friable loam; and brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 34 inches. In some places the soil has a thinner surface layer and may have a subsurface layer of dark grayish brown loam. In other places, the depth to bedrock is less than 20 inches or the bedrock is at the surface.

Permeability is moderate. Surface runoff is medium. Available water capacity is low. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and potassium.

Most areas are used for pasture. Some are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is subject to erosion. It may be droughty in years of average or below average rainfall. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves moisture. The soil is not well suited to contour farming or terracing because slopes generally are short and irregular and limestone is about 20 to 40 inches below the surface. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material conserves moisture and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. The pasture can be easily overstocked because the available water capacity is low. Overgrazing causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many small areas support hardwood timber. This soil is well suited to trees. No major hazards or limitations affect new stands of trees if the proper species are selected for planting and the stand is managed properly.

The land capability classification is IIIe.

914E—Winneshiek loam, 9 to 18 percent slopes. This strongly sloping and moderately steep, well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is about 24 inches thick. In sequence downward, it is brown and very dark grayish brown, friable loam; brown, friable loam; dark yellowish brown, friable loam; and brown, firm clay. Hard, fractured limestone bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is less than 20 inches.

Permeability is moderate. Surface runoff is medium or rapid. Available water capacity is low. The shrink-swell potential is high in the lower part of the subsoil. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a very low supply of available phosphorus and potassium.

Most areas are wooded or are used as permanent pasture. This soil is generally unsuited to cultivated crops because of the slope and a severe hazard of erosion. It is only moderately suited to hay. If cultivated crops are grown, erosion is a severe hazard. Soil loss through erosion adversely affects vegetative growth by reducing the depth to bedrock. Good tilth generally can be easily maintained.

A cover of pasture plants or hay is effective in controlling erosion. The pasture can be easily overstocked because the available water capacity is low. Overgrazing causes surface compaction and poor tilth and increases the runoff rate. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

Many areas support hardwood timber. This soil is moderately well suited to trees. Carefully selecting sites for logging trails and roads and laying out the trails and roads on or nearly on the contour help to control erosion. Because of the slope, operating equipment is somewhat hazardous. Seedlings survive and grow well on this soil.

The land capability classification is VIe.

930—Orion silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on narrow bottom land and alluvial fans. It is occasionally flooded. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is about 11 inches of dark grayish brown silt loam that has thin strata of yellowish brown. The upper substratum is stratified dark grayish brown, very dark grayish brown, and grayish brown silt loam about 17 inches thick. Below this is an older, buried surface layer of black silt loam about 16 inches thick. The lower substratum to a depth of about 60 inches is very dark grayish brown and black silt loam. In some areas the surface layer is very dark gray.

Included with this soil in mapping are small areas of poorly drained soils in the lower positions on the bottom land. These soils make up about 5 percent of the unit.

Permeability is moderate in the Orion soil. Surface runoff is slow. Available water capacity is very high. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 1 to 3 percent in the surface layer. The soil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. Some are used as permanent pasture. If drained and protected from flooding, this soil is well suited to corn, soybeans, and small grain. It is commonly wet as a result of the flooding, the slow runoff, and the seasonal high water table. Tile drains function well if suitable outlets are available. In some years the floodwater damages crops during periods of heavy rainfall. It can be controlled, however, by diversion terraces, dikes, or levees. Good tilth generally can be easily maintained.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing during wet periods, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Seedlings can survive if competing vegetation is controlled or removed by careful site preparation or by spraying or cutting.

The land capability classification is IIw.

933—Sawmill silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is on flood plains. It is occasionally flooded, unless it is protected. Individual areas are irregular in shape and commonly range from 5 to 100 acres in size. A few areas, however, are as large as 300 acres.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsurface layer is black silty clay loam about 14 inches thick. Below this is a transitional layer of very dark gray, friable silty clay loam about 10 inches thick. The subsoil is friable, mottled silty clay loam about 18 inches thick. The upper part is dark gray, the next part is olive gray, and the lower part is light olive gray. The substratum to a depth of about 60 inches is mottled olive gray, yellowish red, and strong brown silt loam. In some places about 12 inches of recently deposited silt loam overlies the surface layer. In other places the subsurface layer is more than 20 inches thick.

Included with this soil in mapping are small areas of the well drained Judson and somewhat poorly drained Ely soils. These soils are slightly higher on the landscape than the Sawmill soil, can be tilled more easily, and dry out more rapidly after rains. They make up less than 10 percent of the unit.

Permeability is moderate in the Sawmill soil. Surface runoff is slow. Available water capacity is very high. The soil has a seasonal high water table within a depth of 2 feet. The content of organic matter is about 5 to 7 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. A drainage system is needed to reduce the wetness and improve the timeliness of fieldwork. Tile drains work well if they are properly installed and if adequate outlets are available. Tilth generally is fair. The surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet improve tilth and fertility, help to prevent surface crusting, and increase the rate of water infiltration.

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

The land capability classification is IIw.

976—Raddle silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces along the major streams and rivers. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown silt loam about 10 inches thick. The subsurface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is friable silt loam about 33 inches thick. The upper part is brown, the next part is dark yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is mottled brown and light brownish gray silt loam. In some places the lower part of the substratum is sandy loam. In other places the surface soil is more than 24 inches thick.

Permeability is moderate. Surface runoff is slow. Available water capacity is very high. The content of organic matter is about 3.5 to 4.5 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It occasionally receives local runoff from the soils upslope. Establishing diversion terraces on soils upslope helps to protect this soil from overflow and siltation. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and results in poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is I.

976B—Raddle silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on terraces along the major streams and rivers. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown silt loam about 10 inches thick. The subsurface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is friable silt loam about 33 inches thick. The upper part is brown, the next part is dark yellowish brown, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is mottled brown and light brownish gray silt loam. In some places the lower part of the substratum is sandy loam. In other places the surface soil is more than 24 inches thick.

Permeability is moderate. Surface runoff is medium. Available water capacity is very high. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It occasionally receives local runoff from the soils upslope. Establishing diversion terraces on the soils upslope helps to protect this soil from runoff and siltation. If row crops are grown year after year, erosion is a hazard. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and increases the likelihood of puddling. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

981B—Worthen silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on alluvial fans and upland foot slopes. Individual areas are elongated and range from 2 to 10 acres in size.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is very dark brown silt loam about 13 inches thick. The subsoil is friable silt loam about 33 inches thick. The upper part is dark brown, and the lower part is brown. The substratum to a depth of about 60 inches is brown silt loam.

Included with this soil in mapping are a few moderately sloping soils on foot slopes. These soils are more susceptible to erosion than the Worthen soil. They make up less than 5 percent of the unit.

Permeability is moderate in the Worthen soil. Surface runoff is medium. Available water capacity is very high. The content of organic matter is about 3 to 5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

A cover of pasture plants is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The land capability classification is IIe.

1291—Atterberry silt loam, benches, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on loess-covered benches along streams. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is brown, mottled silty clay loam; the next part is light brownish gray and grayish brown, mottled silty clay loam; and the lower part is mottled light brownish gray and yellowish brown silt loam. The substratum to a depth of about 60 inches is mottled light olive gray, light brownish gray, and yellowish brown silt loam. Coarse sand and gravel are commonly below a depth of 60 inches. In places coarse sand is within a depth of 60 inches.

Permeability is moderate. Surface runoff is slow. Available water capacity is high. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 3 to 4 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Subsurface drains are needed in some areas to lower the water table and permit timely fieldwork. In some areas conservation practices are needed on soils upslope to help control runoff and siltation onto this soil. Returning crop residue to the soil or regularly adding other organic material to the plow layer improves fertility and maintains good tilth.

If this soil is used for pasture, grazing should be restricted during wet periods. Overgrazing or grazing when the soil is too wet causes surface compaction and results in poor tilth. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is moderately well suited to trees. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by proper site preparation, by prescribed burning, or by spraying, cutting, or girdling.

The land capability classification is I.

1291B—Atterberry silt loam, benches, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on loess-covered benches along streams. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is brown, mottled silty clay loam; the next part is light brownish gray and grayish brown, mottled silty clay loam; and the lower part is mottled light brownish gray and yellowish brown silt loam. The substratum to a depth of about 60 inches is mottled light olive gray, light brownish gray, and yellowish brown silt loam. Coarse sand and gravel are commonly below a depth of 60 inches. In places coarse sand is within a depth of 60 inches.

Permeability is moderate. Surface runoff is medium. Available water capacity is high. The soil has a seasonal high water table at a depth of 1 to 3 feet. The content of organic matter is about 2.5 to 3.5 percent in the surface layer. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Good tilth generally can be easily maintained, but the surface layer tends to crust after periods of heavy rainfall and puddle if the soil is tilled when wet. Subsurface drains are generally needed to permit timely fieldwork. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and conserves soil moisture. Returning crop residue to the soil or regularly adding

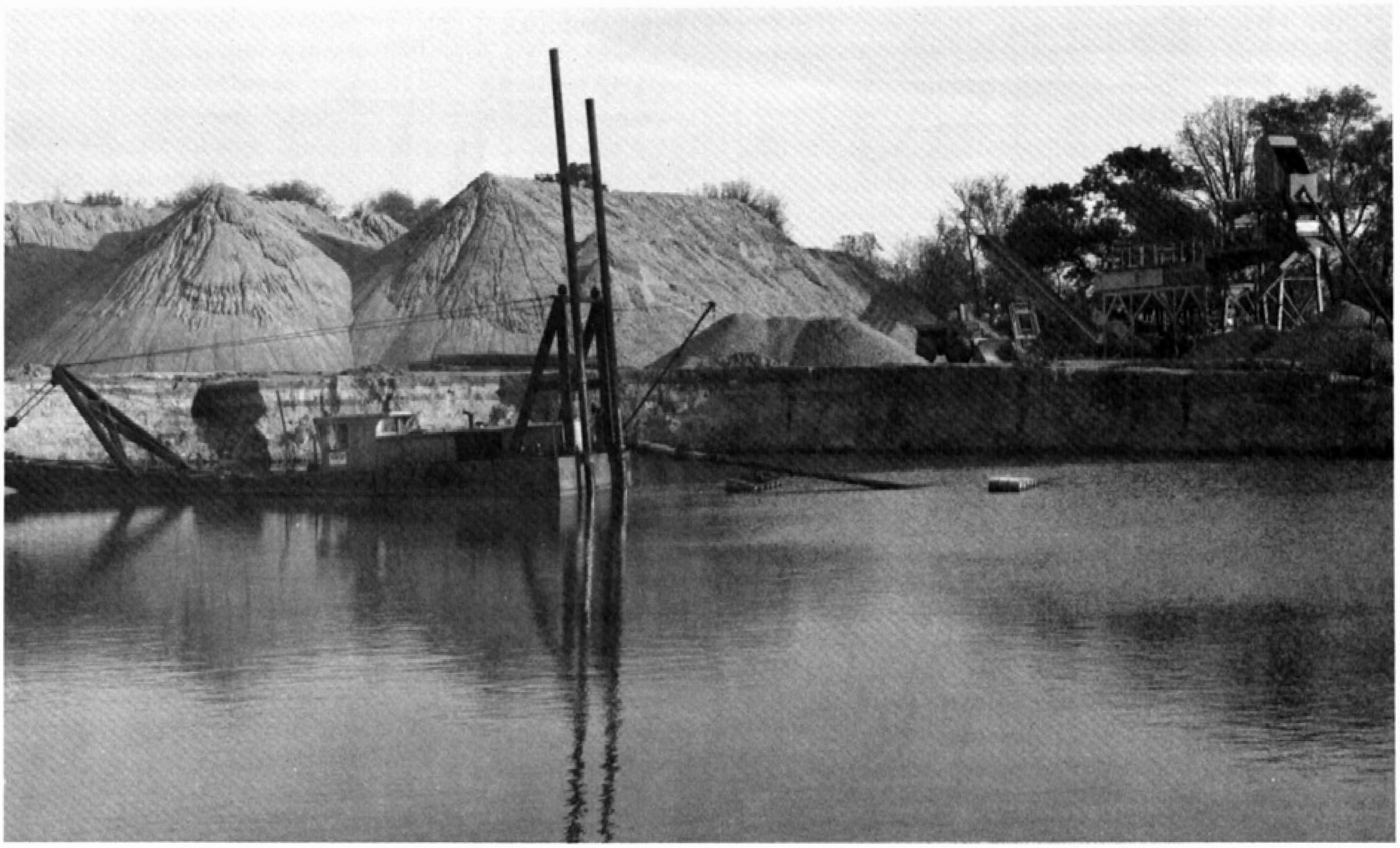

Figure 10.—An area of Pits, sand and gravel.

other organic material improves fertility, helps to prevent soil crusting, and increases the rate of water infiltration.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and results in poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is moderately well suited to trees if competing vegetation is controlled or removed.

The land capability classification is IIe.

5010—Pits, sand and gravel. This map unit consists of borrow pits, sand pits, and gravel pits on flood plains, stream terraces, and uplands (fig. 10). About 5 to 20 feet of material has been removed from the pits, primarily for use in construction. Some of the pit areas are surrounded by piles of spoil. Some of the pits are being mined while others have been abandoned. Some areas have been reshaped, but most have steep sides that support little or no vegetation. Some of the pits contain water, a few feet to many feet deep. The pits are irregular in shape and range from 2 to about 40 acres in size.

The spoil surrounding the pits varies in texture but generally is sandy and contains variable amounts of gravel. The origin of the mined material is glacial outwash or eolian material in the uplands and alluvium on flood plains and stream terraces.

All or part of the areas that are no longer mined for sand and gravel can be reclaimed for alternative uses. These areas are well suited to wildlife habitat, and some of the ponds could support fish. Because of the steepness of the side slopes and the variable depth of the water, however, the pits could be dangerous sites for recreational development and wildlife habitat. Onsite investigation is needed to determine the hazards involved and the best use of the pit and spoil areas.

No land capability classification is assigned.

5030—Pits, limestone quarries. This map unit consists of pits from which limestone has been quarried, primarily for use in road construction, for building stone, and as agricultural lime. The quarries are about 15 to more than 100 feet deep, of which 5 to 40 feet or more is commonly overburden. Piles of spoil 15 or more feet high commonly surround the quarries. Some quarries contain water that is a few feet to many feet deep. Most have nearly vertical sides. The pits are irregular in shape and range from 2 to more than 100 acres in size.

The spoil surrounding the pits varies in texture and contains varying amounts of limestone fragments. It is mainly derived from glacial till or eolian material. In some areas it has been leveled and smoothed, but in other areas it is very uneven. Establishing grasses or trees is fairly easy in the leveled areas. The spoil generally ranges from medium acid to mildly alkaline.

The vacated quarries generally have poor potential for wildlife habitat. Those containing water could support fish. Because of the steepness of the sides and the variable depth of the water, however, the pits could be dangerous as sites for recreation and wildlife habitat. Onsite investigation is needed to determine the suitability of a specific area and the hazards involved.

No land capability classification is assigned.

5040—Orthents, loamy. This map unit consists of nearly level to very steep, mechanically disturbed soils on uplands, stream terraces, and flood plains. Most areas have been cut or filled for road construction, used as borrow areas, or excavated for building site development. In some areas the original soil has been removed to a depth of 5 to 20 feet or more, and in other areas the topsoil has been redistributed. The soils range from excessively drained to somewhat poorly drained, depending on the kind of material from which the soils were derived and the extent to which the borrow area was restored. The texture of these soils varies but generally is loamy. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Included with these soils in mapping are small areas of sand and a few areas that were once dumps or landfills and have now been covered.

Permeability varies, depending on the texture and density of the soils. Runoff is slow to very rapid. Available water capacity is generally moderate or low. Soil material that was once buried 5 to 20 feet or more beneath the surface has less pore space and is more dense than the original surface layer. This previously buried material has not been appreciably affected by the processes of soil formation, such as freezing and thawing. The content of organic matter is very low unless the topsoil has been redistributed throughout the area. As a result, preparing a good seedbed is difficult and drought is a hazard. In most areas these soils have a very low supply of available phosphorus and potassium.

Some areas are cultivated, and some are used as permanent pasture or support weeds. These soils are best suited to small grain and to grasses and legumes for hay and pasture. The areas where topsoil has been redistributed are better suited to row crops, such as corn and soybeans. Erosion is a moderate or severe hazard in the more sloping areas. A system of conservation tillage that leaves crop residue on the surface and only minimally disturbs the surface helps to prevent excessive soil loss and stabilize the soils.

No land capability classification is assigned.

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 meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 169,290 acres in the survey area, or nearly 45 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the northwest corner and in the central and southwestern parts, mainly in associations 2, 4, 5, and 6, which are described under the heading "General Soil Map Units." Nearly 100 percent of this prime farmland is used for crops. The crops grown on this land, mainly corn and soybeans, account for a major portion of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland 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 less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

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

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.

According to the State of Iowa Annual Farm Census, 251,200 acres in Jones County was used for cultivated crops and 45,000 acres for pasture in 1986. Corn, soybeans, oats, and legume-grass hay were the main crops. Corn was grown on about 171,000 acres. Many of the soils in the county are well suited to increased production of crops and much of this increase could come from extending the latest crop production technology, including soil conservation practices, to all existing cropland in the county. The soils and climate in the survey area also are suited to some crops that are not commonly grown in the area, such as native prairie grasses for seed, many vegetables and small fruits, sweet corn, and orchards and nursery plants. The latest information and suggestions for growing suitable crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

The main management needs on the cropland in Jones County are measures that control erosion, drain naturally wet soils and seep areas, and maintain or improve fertility. The paragraphs that follow describe the management concerns affecting the use of the soils in the county for crops and pasture.

Soil erosion is the major hazard on more than 35 percent of the cropland and pasture in the county. Measures that control erosion are needed on Atterberry, Backbone, Bassett, Bertram, Billett, Bolan, Brady, Chelsea, Curran, Dickinson, Dinsdale, Downs, Dubuque, Ely, Emeline, Exette, Fayette, Finchford, Flagler, Franklin, Judson, Kenyon, Klinger, Lamont, Lindley, Muscatine, Nordness, Olin, Orwood, Ostrander, Raddle, Ripon, Rockton, Sattre, Saude, Sparta, Tama, Terril, Timula, Waubeek, Waukee, Waukegan, Winneshiek, and Worthen soils.

Organic matter is an important source of nitrogen for crops. It also increases the rate of water infiltration, reduces surface crusting, reduces soil losses from erosion, and promotes good tilth.

Loss of the surface layer through erosion reduces the productivity of soils and results in sedimentation in drainage systems. 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 especially damaging to soils with a subsoil that is low in fertility, such as Bassett and Kenyon soils, and on soils with a layer in or below the subsoil that restricts the root zone. An example of this kind of layer is the limestone bedrock underlying Backbone, Bertram, Dubuque, Emeline, Nordness, Ripon, Rockton, and Winneshiek soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Billet, Chelsea, Dickinson, Flagler, Finchford, Lamont, and Sparta soils. Seedbed preparation and tillage are difficult on eroded soils because the original friable surface layer has been removed or thinned and the more strongly structured subsoil is often hard and cloddy after rains or if it has been tilled when wet.

Runoff from soils often can become a damaging pollutant and can cause sedimentation in ponds, streams, drainageways, and road ditches. Control of erosion helps to maintain the productivity of the soils and lessens pollution of water for municipal use, for recreation, and for fish and other kinds of wildlife.

Jones County has a variety of soil and landscape features that require a variety of erosion-control practices. Ideal methods of erosion control provide protection, reduce the rate of runoff, and increase the rate of water infiltration. Among the measures that help to control erosion are cover crops, contour tillage, terraces and diversions, grassed waterways, windbreaks, and conservation tillage. Usually, a combination of several measures is most effective. A cropping system that keeps a plant cover on the surface can reduce soil loss to an amount that will not decrease the productive capacity of the soils. On livestock farms, where part of the acreage is hayland, using grasses and legumes in the cropping system not only provides nitrogen and improves tilth for the next cropping season but also helps to control erosion on the more sloping soils.

Conservation tillage has received considerable interest as a means of controlling erosion, especially on sloping soils. Following are examples of the major kinds of conservation tillage systems that are designed to leave crop residue on the surface.

No-till is a system in which seedbed preparation and planting are completed in one operation. There is little or no soil disturbance except in the immediate area of the planted seed row. Mulch tillage is a system in which the soil is loosened throughout the field and part of the crop residue is incorporated into the soil. Preparing the seedbed and planting may be one or separate operations. Mulch tillage is effective if at least 30 percent of the surface is covered with crop residue after planting. Particularly in areas where row crops are grown year after year, no-till and mulch tillage systems are generally successful on sandy, excessively drained soils, such as Dickinson and Sparta soils, and on silty, well drained, highly erodible soils, such as Fayette and Orwood soils. Ridge tillage is a system in which seedbed preparation and planting are completed in one operation on ridges 8 to 9 inches high. Less than one-third of the field area is disturbed.

Terraces and diversions control runoff and erosion by reducing the length of the slopes. They are most practical on deep, well drained or moderately well drained soils that have long, uniform slopes. Many areas of Downs, Fayette, and Tama soils are well suited to terracing. Other soils are less well suited to terraces and diversions because slopes are irregular or are too steep or because bedrock is within a depth of 40 inches. Examples are Backbone, Dubuque, Emeline, and Rockton soils. Terracing is not practical on Billett, Chelsea, Timula, Sparta, and other soils that have short, irregular slopes and are coarse textured or moderately coarse textured. On these soils a cropping system that provides a substantial plant cover and a system of conservation tillage that leaves crop residue on the surface are effective in controlling erosion.

In areas of soils in which all or part of the subsoil formed in glacial till, such as Bassett, Dinsdale, Kenyon, and Lindley soils, the topsoil should be stockpiled during terrace construction and the exposed subsoil should be covered when the terraces are completed. Diversion terraces commonly are installed upslope from the Judson and Terril soils to control the runoff from the upland slopes onto the foot slopes and into the drainageways.

Contour farming and contour stripcropping help to control erosion on many soils in the county. They are most effective in areas where slopes are smooth and uniform, including most areas of Downs, Fayette, and Tama soils.

Wind erosion is a hazard on the sandy Chelsea and Sparta soils and on the organic Palms soils. If the winds are strong and the soils are dry and without a cover of vegetation, erosion damage can occur in a short period. Row crops on these soils and on adjacent soils may also be damaged by the blowing sand. The wind erosion can be controlled by a plant cover, surface mulch, or tillage methods that keep the surface rough. On the organic soils it can be controlled by windbreaks of suitable shrubs, such as Tatarian honeysuckle and autumn-olive, or by strips of grass.

Controlling erosion may be difficult on Bassett, Dinsdale, Kenyon, Lindley, Olin, and Ostrander soils because the upper part of these soils is loamy and more rapidly permeable than the glacial till in the lower part of the subsoil and in the substratum. Water tends to accumulate at the point where the loamy material comes in contact with the till. As a result, hillside seepage can occur during wet periods. A combination of terraces and tile drains is needed on these soils.

Gully-control structures, grassed waterways, and farm ponds are used to control erosion in watercourses. Farm ponds also provide a supply of water for livestock and for recreation. Information on the design of erosion-control practices for each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil drainage is a major management concern on about 28 percent of the soils in Jones County. Poorly drained and somewhat poorly drained soils in the county are mainly in upland drainageways in or adjacent to areas underlain by glacial till or on bottom land adjacent to major rivers and streams. To offset the effects of unfavorable soil moisture conditions, drainage is typically needed on the Atterberry, Clyde, Colo, Ely, Floyd, Franklin, and Klinger soils in the upland drainageways and on the Hayfield, Lawler, Marshan, and Sawmill soils on bottom land. Draining soils that are somewhat poorly drained or poorly drained should increase yields and expand the choice of crops that can be grown. The design of surface and subsurface drainage systems varies with the kind of soil. Surface drains and measures that control the runoff from the slopes at the higher elevations are needed in most areas of the somewhat poorly drained and poorly drained soils used for intensive row cropping. The drains should be more closely spaced in the moderately slowly permeable soils than in the more rapidly permeable soils. Interceptor tile drains may need to be installed laterally, upslope from the more slowly permeable soils, to intercept and drain excessive moisture at the loess-till or sand-till contact.

Organic soils oxidize and subside when their pore space is filled with air. As a result, special drainage systems are needed to control the depth and the period of drainage in, for example, the Palms soils. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and the subsidence of these soils.

Soil fertility is affected by the supply of available phosphorus and potassium in the subsoil, by reaction, and by the organic matter content of the surface layer. The supply of available phosphorus and potassium is low or very low in most soils in the county. Fayette soils, however, have a high supply of available phosphorus and Downs soils, a medium supply. Most of the upland soils have an acid subsoil. Applications of ground limestone are needed to raise the pH level sufficiently for alfalfa and other crops. The poorly drained Clyde soils and the somewhat poorly drained Floyd soils generally are neutral in reaction. The soils that formed in alluvium on bottom land are typically neutral or mildly alkaline. They generally have a low or very low supply of available phosphorus and potassium in the subsoil. On all soils, the need for lime and fertilizer should be based on results of soil tests, on the needs of the crop, and on expected yield levels. The Cooperative Extension Service can provide information on the proper collection of soil samples for testing and on the interpretation of the results of those tests.

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 generally are high in organic matter content and are granular and porous. In most of the uneroded, medium textured, well drained upland soils that formed under forest vegetation, such as Fayette soils, the organic matter content is about 1 to 2 percent in the surface layer. In the eroded soils, however, it generally is less than 1 percent. It is about 2 to 3 percent in the medium textured, well drained soils that formed under grasses and trees, such as Bassett and Downs soils. It is about 3 to 4 percent in the medium textured, well drained soils that formed under prairie grasses, such as Dinsdale, Kenyon, Ostrander, and Tama soils, and 7 to 11 percent in the poorly drained upland soils, such as Colo, Clyde, and Sawmill soils. Soils that formed in alluvium on bottom land vary greatly in their organic matter content, depending on the source of the soil material. The content of organic matter is about 1 percent in Chaseburg soils, 4 to 8 percent in Marshan soils, and more than 75 percent in the very poorly drained, organic Palms soils.

Soils that are eroded and have a moderately low or low organic matter content typically have a surface layer that has weak structure. A crust may form on those soils during periods of intense rainfall. The crust becomes hard when dry, thus reducing the rate of water infiltration and increasing the runoff rate. Regular additions of crop residue, manure, and other organic material improve soil structure and tilth and help to prevent crusting.

Fall plowing generally is not a desirable practice on the soils of this county because it increases the susceptibility of the soil to water and wind erosion. Many of the soils that are fall-plowed are nearly as dense and hard at the time of planting as they were before they were plowed. The soils are best protected by conservation tillage or winter cover crops following crop harvest.

Most of the permanent pastures in the county support bluegrass, but some support a grass-legume mixture, such as alfalfa and bromegrass. Most of the bluegrass pastures are not used as cropland because the soils are too steep for cultivation. Good grazing management is especially important on steep slopes to prevent soil compaction and gully erosion. Proper management practices for established stands include applications of fertilizer, weed and brush control, rotation and deferred grazing, proper stocking rates, and adequate livestock watering facilities. Some pastures have been renovated and planted to birdsfoot trefoil or crownvetch. Interseeding grasses and legumes into the existing sod eliminates the need for destroying the plant cover during seedbed preparation.

The latest information about growing crops can be obtained from local offices 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 6. 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 land capability classification of each map unit also is shown in the table.

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 also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 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 for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland 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 few 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 hazard is the 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, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

The woodland in Jones County makes up about 28,300 acres, or about 7 percent of the total acreage. The trees provide products for sale or for use on the farm. In addition, they help to prevent excessive erosion and provide cover for wildlife.

Many of the wooded areas are in the most strongly sloping soil associations shown on the general soil map of the county. Most are in the Fayette-Downs-Exette association, the Fayette-Nordness-Rock outcrop association, and the Chelsea-Orwood-Sparta association. There are a few woodlots in other associations, but most of the trees are scattered in pastures, along drainageways and fence rows, and around farmsteads. In many places, particularly in associations 1 and 3, the land that is wooded is steep, shallow to limestone bedrock, and unsuitable for cultivation. Many areas now used for crops have a border of woods, and some trees grow in most places that are pastured. Much of the steep or very steep land bordering the Maquoketa River is not suited to crops and is poorly suited to pasture. In these areas the stands of trees are extremely important because they help to control erosion. The towering limestone bluffs surrounded by trees make these areas of the county among the most scenic in eastern Iowa.

The native woodland in the county can be kept productive by good management practices, including protection from livestock and fire, group selection and clearcut harvesting, thinning and planting, and woodland weeding. Many of the woodland tracts have been used for grazing and have been poorly managed. Grazing damages a wooded area as much as overcutting or burning. The grazing animals trample the soil, causing erosion, and their browsing damages or kills the young trees and undergrowth. Wooded areas used for grazing usually do not provide enough forage to be desirable as pasture.

The management of a wooded area depends on its condition and on the kinds of trees to be grown. The objective in woodland management is to attain sustained production by cutting the amount of wood that the stand is producing in yearly growth. This cutting can be done each year or every 5 to 10 years. Some woodland may be of such poor quality, however, that the best procedure is to convert it from the poor-quality hardwoods to the more valuable hardwood species, such as oak, walnut, and ash. Before this conversion, competition from inferior species of trees, shrubs, and weeds must be eliminated.

Several agencies in Iowa can assist woodland owners in improving their products and marketing them. The Soil Conservation Service can help determine which soils are suitable for trees, best land use, yields, and conservation treatment needs. Foresters of the Iowa Department of Natural Resources can assist in developing plans for managing new or old stands of trees.

Soils differ in their capabilities for use as woodland. The factors that influence such use are different and less restrictive than those that limit the use of soils for cultivated crops. Some of those factors are described in the following paragraphs.

Moisture.—The growth of trees is directly related to the ability of a soil to supply moisture. The available moisture capacity of any soil depends largely on the slope, effective depth, texture, permeability, and internal drainage. Examples of soils and land types that have only a limited supply of available moisture are the Chelsea, Nordness, and Sparta soils and the Nordness-Rock outcrop complex.

Aspect, or direction of exposure.—Studies show a relationship between the exposure of a site and the rate of tree growth. Generally, growth is rapid and yields are high on north- and east-facing, nearly level or gently sloping bottom land and broad ridgetops. Long, steep slopes that have various exposures are typical in the areas of Fayette and Nordness soils and the Nordness-Rock outcrop complex.

Soil reaction and soil fertility.—These factors have some influence on the adaptation and growth of different species of trees. For example, walnut and locust trees grow best on neutral or slightly calcareous soils. Most pine trees need a slightly acid soil, especially the native species, and thus are poorly suited to soils that are high in content of lime. On the other hand, most hardwoods commonly grow well on those soils and eastern redcedar is tolerant of lime. Some severely eroded areas of Timula soils contain large amounts of lime in the upper 2 to 3 feet.

Trees to be planted on eroded or depleted soils should be carefully selected. Commercial soil tests for nutrient levels are as important for proper management of trees as they are for cultivated crops. The Soil Conservation Service, the Iowa Department of Natural Resources, or the Cooperative Extension Service can help determine specific woodland management needs.

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 symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed also are subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *productivity class*. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for 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 (fig. 11).

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are predicted 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 commercial nursery.

Recreation

Many areas in the county are used for camping, hiking, hunting, fishing, canoeing, snowmobiling, sightseeing, or picnicking (fig. 12). The public lands available for recreation include Indian Bluffs State Wildlife Management Area, Pictured Rocks State Park, Wapsipinicon State Park, Muskrat Slough Game Management Area, Jones County Central Park, and numerous county- and state-owned river access areas. The county also has many private recreational facilities, including golf courses, hunting and fishing clubs, and campgrounds. The historic Stone City area, in extreme west-central Jones County, attracts many visitors each year.

Use of recreation areas in the county has increased greatly in the past several years, creating a demand for new and improved facilities. Many of the soils in Jones County are well suited to the development of recreational facilities. The areas of hilly to rugged terrain, the wooded slopes, the exposed rock formations, and the many rivers and streams provide a variety of opportunities for 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 sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are 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 are gently sloping 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

Figure 11.—Windbreak of honeysuckle and evergreen trees in an area of Tama silt loam, 2 to 5 percent slopes.

Figure 12.—Recreational development in an area of the Fayette-Downs-Exette association.

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 should be considered.

Paths and trails for hiking and horseback riding 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

Jones County has a large and varied population of fish and wildlife and a wide range of habitat. Wooded areas are in the northeastern part of the county and along the major rivers and streams, and a few wetlands are in the southern part. White-tailed deer, wild turkey, squirrel, turkey vultures, and owls inhabit the wooded areas. Quail, partridge, cottontail rabbits, woodchucks, ringneck pheasants, coyote, red fox, and many types of songbirds live in the cultivated areas and wooded fringe areas where they find food and cover. Muskrat, beaver, raccoon, blue heron, woodchuck, mallards, and Canada geese inhabit the ponds, marshes, and streambanks. Some of the ponds and wetlands, such as the Muskrat Slough State Game Management Area, also provide resting and feeding areas for migratory waterfowl. Fishing is generally limited to a few manmade lakes and farm ponds and the Wapsipinicon and Maquoketa Rivers. Largemouth and smallmouth bass, catfish, bluegill, northern pike, walleye, and bullheads are the main species that occupy these waters.

Nesting cover is the most critical factor affecting the number of wildlife in an area. The most successful cover in intensively farmed areas is in road ditches and along fence lines. Studies by the Iowa Department of Natural Resources have shown that wildlife populations can be increased significantly if the plant cover in these areas is left unclipped until early summer. Winter cover can be provided through farmstead or field windbreaks and wildlife plantings. Winter cover should be near a source of food, such as a few rows of grain in a field that is adjacent to a windbreak or other wildlife planting. Small odd-shaped areas, generally unsuitable for farming, can provide excellent 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 also are 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, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, 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 and seeds. 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 quail, 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. The wildlife attracted to these areas include wild turkey, ruffed grouse, 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 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the 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 or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. 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, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills 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, 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, the available water capacity in the upper 40 inches, and the content of calcium carbonate 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, and flooding affect absorption of the effluent. Large stones and bedrock 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, 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 and bedrock 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, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction 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 wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

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, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have 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 depth to the water table is less than 1 foot. These soils 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 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, and bedrock.

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 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 or stones, 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; embankments, dikes, and levees; and aquifer-fed excavated ponds. 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, 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.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

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 affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, 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 classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

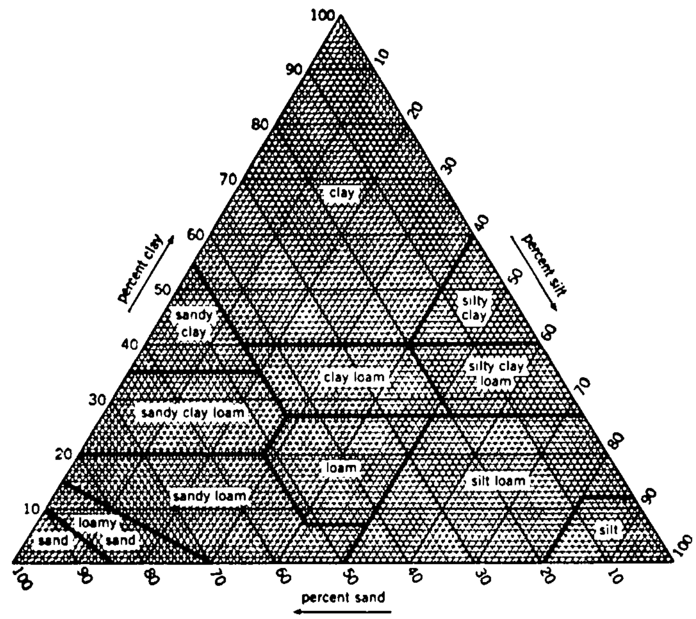

Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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 (fig. 13) 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 about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(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, CL-ML.

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.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

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. Soils are grouped according to the following distinctions:

1. Coarse sands, 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 coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

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 infiltration 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.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

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, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, 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.

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 are 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 depth to the seasonal high water table; the kind of water table—that is, perched 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. 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.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

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 also is 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 *(11)*. 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. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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 Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

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 Udifluvents (*Udi*, meaning humid, plus *fluvent*, the suborder of the Entisols that has a udic 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 Udifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, 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 coarse-silty, mixed, nonacid, mesic Typic Udifluvents.

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. 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 (10)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (11)*. 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."

Ankeny Series

The Ankeny series consists of well drained, moderately rapidly permeable soils on foot slopes, alluvial fans, and stream terraces. These soils formed in alluvium or eolian material. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Ankeny fine sandy loam, 0 to 2 percent slopes, in a cultivated field; 880 feet north and 2,200 feet west of the southeast corner of sec. 9, T. 86 N., R. 3 W.

Ap—0 to 7 inches; black (10YR 2/1) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

A1—7 to 16 inches; very dark brown (10YR 2/2) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; neutral; gradual smooth boundary.

A2—16 to 22 inches; very dark brown (10YR 2/2) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; few fibrous roots; neutral; gradual smooth boundary.

A3—22 to 38 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium and fine subangular blocky structure; very friable; neutral; clear smooth boundary.

Bw—38 to 47 inches; brown (10YR 4/3) sandy loam; very weak fine subangular blocky structure; very friable; dark brown (10YR 3/3) coatings on faces of peds; slightly acid; clear smooth boundary.

2E/Bt—47 to 59 inches; brown (10YR 4/3) fine sand (E); single grain; loose; lamella of brown (7.5YR 4/4) and dark brown (7.5YR 3/2) sandy loam (Bt) between depths of 57 and 59 inches; neutral; gradual smooth boundary.

2C—59 to 60 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; neutral.

The solum ranges from 40 to 60 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. It ranges from 24 to 40 inches in thickness. It is fine sandy loam or sandy loam. The Bw horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. The content of sand in this horizon ranges from 60 to 70 percent. The 2C horizon has value of 4 or 5 and chroma of 3 to 6. It is fine sandy loam to sand.

Ansgar Series

The Ansgar series consists of poorly drained, moderately permeable soils in level or slightly depressional areas on broad upland divides. These soils formed in loess and in the underlying glacial till. The native vegetation was mixed deciduous trees and water-tolerant prairie grasses. Slope is 0 to 1 percent.

Typical pedon of Ansgar silt loam, 0 to 1 percent slopes, in a cultivated field; 260 feet east and 1,800 feet south of the northwest corner of sec. 19, T. 84 N., R. 4 W.

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

E1—7 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak thin platy structure; friable; few faint light gray (10YR 7/2 dry) silt coatings on faces of peds; neutral; clear smooth boundary.

E2—10 to 15 inches; grayish brown (2.5Y 5/2) silt loam, light brownish gray (2.5Y 6/2) dry; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium platy structure parting to moderate very fine subangular blocky; friable; few faint light gray (10YR 7/2 dry) silt coatings on faces of peds; medium acid; abrupt smooth boundary.

Btg1—15 to 21 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; few faint clay films on vertical faces of peds; medium acid; gradual smooth boundary.

Btg2—21 to 31 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium and fine angular and subangular blocky; friable; common distinct clay films on vertical faces of prisms; slightly acid; gradual smooth boundary.

2Btg3—31 to 38 inches; mottled grayish brown (2.5Y 5/2), dark grayish brown (10YR 4/2), and strong brown (7.5YR 5/6) loam; moderate coarse prismatic structure parting to moderate medium and fine angular blocky; firm; few distinct clay films on vertical faces of prisms; few fine pebbles; slightly acid; clear smooth boundary.

2BC—38 to 45 inches; mottled yellowish brown (10YR 5/6), light olive gray (5Y 6/2), yellowish red (5YR 5/6), and dark grayish brown (2.5Y 4/2) loam; weak coarse prismatic structure; firm; few fine dark soft accumulations of manganese oxide; few fine pebbles; neutral; gradual smooth boundary.

2C—45 to 60 inches; light olive brown (2.5Y 5/4) loam;

common medium prominent yellowish red (5YR 5/6), few fine prominent red (2.5YR 5/6), and few medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; few fine very dark soft accumulations of manganese oxide; few fine pebbles; mildly alkaline; slight effervescence.

The solum ranges from 40 to 80 inches in thickness, and the loess ranges from 24 to 36 inches in thickness. The Ap or A horizon has value of 2 or 3. The E or BE horizon and the Btg horizon have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. The Btg horizon is silty clay loam in which the content of clay is 30 to 35 percent. The 2Btg, 2BC, and 2C horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6. They are loam, sandy clay loam, or clay loam.

Arenzville Series

The Arenzville series consists of moderately well drained, moderately permeable soils on narrow bottom land, on alluvial fans, and in upland drainageways. These soils formed in stratified, silty alluvium 20 to 40 inches deep over a buried soil. The native vegetation was deciduous trees. Slope ranges from 0 to 5 percent.

Typical pedon of Arenzville silt loam, 0 to 2 percent slopes, in a cultivated field; 1,700 feet south and 1,900 feet east of the northwest corner of sec. 26, T. 84 N., R. 4 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; few very thin or thin brown (10YR 5/3) strata; weak thin platy structure parting to weak fine granular; friable; few fine fibrous roots; slightly acid; abrupt smooth boundary.

C—6 to 26 inches; stratified dark grayish brown (10YR 4/2), brown (10YR 5/3), and pale brown (10YR 6/3) silt loam; massive with weak bedding planes resulting largely from stratification during deposition; friable; few fine fibrous roots; neutral; abrupt wavy boundary.

Ab1—26 to 38 inches; black (10YR 2/1) silt loam; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Ab2—38 to 56 inches; very dark gray (10YR 3/1) silt loam; weak fine angular and subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

C′—56 to 60 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct brown (10YR 4/3) mottles; weak fine angular and subangular blocky structure; friable; medium acid.

Depth to the Ab horizon ranges from 20 to 40 inches. The color, arrangement, and thickness of all horizons vary because the source of the material and the pattern of deposition differ from area to area. The Ap horizon has chroma of 1 to 3 and value of 3 to 5. The C and C′ horizons have value of 4 to 6 and chroma of 2 or 3. The Ab horizon is silt loam or silty clay loam. It has chroma of 1 or 2 and value of 2 or 3.

Atterberry Series

The Atterberry series consists of somewhat poorly drained, moderately permeable soils on upland divides and high stream benches. These soils formed in loess. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 0 to 5 percent.

Typical pedon of Atterberry silt loam, 1 to 4 percent slopes, in a cultivated field; 1,480 feet east and 140 feet north of the southwest corner of sec. 28, T. 85 N., R. 2 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

EB—9 to 14 inches; dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; moderate thin platy structure parting to moderate very fine subangular blocky; friable; neutral; clear smooth boundary.

Bt1—14 to 21 inches; brown (10YR 5/3) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine distinct light brownish gray (2.5Y 6/2) mottles; moderate fine subangular blocky structure; friable; few faint clay films on vertical faces of peds in the lower part; neutral; gradual smooth boundary.

Bt2—21 to 30 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6) and common fine faint light gray (2.5Y 7/2) mottles; moderate medium and fine subangular blocky structure; friable; common faint clay films on vertical faces of peds; few fine dark soft accumulations of iron and manganese oxide; medium acid; gradual smooth boundary.

Bt3—30 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam; common very fine faint light gray (2.5Y 7/2) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium and fine angular and subangular blocky structure; friable; common distinct clay films on vertical faces of peds; few fine dark soft accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

Bt4—36 to 42 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6), common fine prominent yellowish brown (10YR 5/8), and few very fine faint light gray (2.5Y 7/2) mottles; weak medium and fine subangular blocky structure; friable; few faint clay films on vertical faces of peds; common fine dark soft accumulations of manganese oxide; medium acid; gradual smooth boundary.

BC—42 to 50 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) silt loam; very weak fine subangular blocky structure; friable; common fine dark soft accumulations of iron and manganese oxide; neutral; gradual smooth boundary.

C—50 to 60 inches; mottled light olive gray (5Y 6/2), light brownish gray (2.5Y 6/2), and yellowish brown (10YR 5/6) silt loam; few very thin or thin strata of sand below a depth of 54 inches; massive; friable; common fine dark soft accumulations of iron and manganese oxide; neutral.

The solum ranges from 42 to more than 60 inches in thickness. The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The BE or E horizon, if it occurs, has value of 4 to 6 and chroma of 1 or 2. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 2 to 4. It is commonly silty clay loam, but the range includes silt loam. The BC and C horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6. They are silt loam or silty clay loam.

Backbone Series

The Backbone series consists of moderately deep, well drained soils on uplands. These soils formed in loamy sediments and in a thin layer of residuum over limestone bedrock. Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 5 to 18 percent.

Typical pedon of Backbone sandy loam, 5 to 9 percent slopes, in a cultivated field; 100 feet west and 240 feet north of the southeast corner of sec. 3, T. 86 N., R. 1 W.

Ap—0 to 9 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; friable; neutral; abrupt smooth boundary.

E—9 to 14 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; brown (10YR 4/3) streaks and pockets in the lower part; weak thin platy structure parting to weak very fine subangular blocky; friable; very dark grayish brown (10YR 3/2) coatings on faces of peds; neutral; gradual smooth boundary.

BE—14 to 18 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; few dark brown (10YR 3/3) coatings on faces of peds; few fine pebbles; neutral; clear smooth boundary.

Bt1—18 to 25 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; neutral; gradual smooth boundary.

2Bt2—25 to 30 inches; dark yellowish brown (10YR 4/4) sandy clay loam; weak fine prismatic structure parting to weak fine angular and subangular blocky; firm; few distinct dark reddish brown (5YR 3/3) clay films on faces of peds; neutral; gradual smooth boundary.

2Bt3—30 to 36 inches; dark brown (7.5YR 3/4), strong brown (7.5YR 4/6), and reddish brown (5YR 4/4) clay; weak fine prismatic structure parting to moderate medium and fine subangular blocky; firm; common faint dark reddish brown (5YR 3/3) clay films on faces of peds; few chert fragments; neutral; abrupt wavy boundary.

R—36 inches; fractured, hard limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The A1 or Ap horizon has chroma of 1 or 2. It is sandy loam, fine sandy loam, or loamy sand. The E horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has value and chroma of 3 to 5. The content of clay in this horizon ranges from 12 to 18 percent. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is clay loam, sandy clay loam, or clay.

Bassett Series

The Bassett series consists of moderately well drained, moderately permeable soils on uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 2 to 18 percent.

Typical pedon of Bassett loam, 2 to 5 percent slopes, in a previously cultivated bluegrass pasture; 840 feet north and 1,360 feet east of the southwest corner of sec. 30, T. 85 N., R. 4 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (2.5Y 5/2) dry; moderate fine granular structure; friable; some fibrous roots; strongly acid; abrupt smooth boundary.

BE—6 to 9 inches; brown (10YR 4/3) loam, grayish brown (10YR 5/2) dry; moderate medium platy structure parting to moderate very fine subangular blocky; friable; few fibrous roots; very strongly acid; clear smooth boundary.

Bt1—9 to 16 inches; dark yellowish brown (10YR 4/4) loam; moderate medium and fine subangular and angular blocky structure; friable; few faint clay films on faces of peds; light gray (10YR 7/1 dry) silt coatings on faces of peds; a stone line at a depth of about 16 inches; medium acid; clear smooth boundary.

2Bt2—16 to 26 inches; yellowish brown (10YR 5/6) loam; moderate medium and fine angular and subangular blocky structure; firm; common distinct brown (7.5YR 4/4) clay films on faces of peds; light gray (10YR 7/1 dry) silt coatings on faces of peds; few pebbles; medium acid; gradual smooth boundary.

2Bt3—26 to 33 inches; brown (7.5YR 4/4) loam; moderate medium prismatic structure parting to moderate medium angular and subangular blocky; firm; common distinct strong brown (7.5YR 5/6) clay films on faces of peds and prisms; few dark soft accumulations of manganese oxide; few pebbles; strongly acid; gradual smooth boundary.

2BC—33 to 40 inches; brown (7.5YR 4/4) loam; many fine distinct dark yellowish brown (10YR 4/4), common fine prominent yellowish brown (10YR 5/6 and 5/8), and few fine prominent reddish brown (5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium angular and subangular blocky; firm; few medium and fine dark soft accumulations of manganese oxide; few pebbles; strongly acid; gradual smooth boundary.

2C—40 to 60 inches; strong brown (7.5YR 5/6) loam; common fine faint strong brown (7.5YR 5/8), few medium prominent yellowish red (5YR 4/6), and few fine prominent light brownish gray (2.5Y 6/2) mottles; massive; firm; many fine dark soft accumulations of manganese oxide at a depth of about 46 inches; few pebbles; slightly acid.

The solum ranges from 36 to 70 inches in thickness.

The loamy sediments are 14 to 26 inches thick. A stone line commonly separates the loamy sediments from the glacial till.

The Ap horizon is commonly loam, but the range includes silt loam. Some pedons have an E horizon. The E or BE horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or higher, and chroma of 3 or higher in the upper part and hue of 7.5YR or 5Y, value of 4 or higher, and chroma of 1 to 8 in the lower part. It is typically loam, but the range includes clay loam and sandy clay loam. The 2BC and 2C horizons have the same range of colors and textures as the lower part of the 2Bt horizon.

The Bassett soils in map units 171C2, 171D2, and 171E2 are taxadjuncts because they have a dark surface layer that is thinner than is defined as the range for the series.

Bertram Series

The Bertram series consists of moderately deep, somewhat excessively drained, moderately rapidly permeable soils on uplands. These soils formed in loamy eolian material and in the underlying residuum over limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Bertram fine sandy loam, 2 to 5 percent slopes, in a cultivated field; 1,700 feet west and 240 feet north of the center of sec. 36, T. 86 N., R. 3 W.

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

A—8 to 16 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; few fine roots; neutral; gradual smooth boundary.

Bw1—16 to 27 inches; dark brown (10YR 3/3) fine sandy loam; weak medium and coarse subangular blocky structure; very friable; few fine roots; medium acid; clear smooth boundary.

2Bw2—27 to 34 inches; dark yellowish brown (10YR 4/4) sandy clay loam; weak medium and coarse subangular blocky structure; friable; some coarse sand; medium acid; clear smooth boundary.

2C—34 to 39 inches; dark yellowish brown (10YR 4/4) sandy clay loam; some hue of 7.5YR in the lower part; single grain; loose; about 10 percent broken limestone fragments ½ inch to 2 inches in diameter; neutral; abrupt wavy boundary.

2R—39 inches; hard limestone bedrock.

The thickness of the solum ranges from 20 to 40 inches. The Ap horizon has value of 2 or 3. The Bw horizon typically has value of 3 to 5 and chroma of 3 or 4. It is sandy loam or fine sandy loam. The 2Bw horizon has colors similar to those of the Bw horizon, but in some pedons it has hue of 7.5YR. It is sandy clay loam or clay loam.

Billett Series

The Billett series consists of well drained, moderately rapidly permeable soils in outwash areas on uplands and stream terraces. These soils formed in loamy sediments and in the underlying sandy material. The native vegetation was mixed deciduous trees and prairie grasses. Slope ranges from 2 to 20 percent.

Typical pedon of Billett sandy loam, 2 to 5 percent slopes, in a cultivated field; 420 feet north and 2,360 feet east of the center of sec. 7, T. 86 N., R. 3 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; few fine fibrous roots; very few fine pebbles; medium acid; abrupt smooth boundary.

Bt1—7 to 13 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; common distinct clay bridges between sand grains; few fine fibrous roots; slightly acid; clear smooth boundary.

Bt2—13 to 20 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; common distinct clay bridges between sand grains; few fine fibrous roots; few fine pebbles; neutral; gradual smooth boundary.

2Bt3—20 to 32 inches; dark yellowish brown (10YR 4/4) loamy sand; very weak fine subangular blocky structure; very friable; common distinct clay bridges between sand grains; few fine fibrous roots; about 10 percent gravel; neutral; gradual smooth boundary.

2Bt4—32 to 42 inches; brown (7.5YR 4/4) gravelly loamy sand; very weak fine subangular blocky structure; very friable; common prominent yellowish red (5YR 4/6) clay bridges between sand grains; few fine fibrous roots; about 15 percent gravel; strongly acid; clear smooth boundary.

2C—42 to 60 inches; mixed yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) sand; single grain; loose; about 10 percent gravel; strongly acid.

The solum ranges from 30 to 60 inches in thickness. The content of gravel ranges from 0 to 15 percent.

The Ap or A horizon has value and chroma of 2 or 3. Pedons in uncultivated areas have a weakly expressed E horizon, which has chroma of 2 or 3. The Bt and 2Bt horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The 2Bt horizon is loamy sand or gravelly loamy sand. The 2C horizon has hue and value similar to those of the Bt and 2Bt horizons, but it has chroma of 4 to 8. It is sand, loamy sand, or gravelly sand.

Bolan Series

The Bolan series consists of well drained soils on uplands and outwash terraces. These soils formed in loamy eolian material. Permeability is moderate in the upper part of the profile and rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Bolan loam, 2 to 5 percent slopes, in a cultivated field; 700 feet south and 400 feet west of the center of sec. 3, T. 86 N., R. 3 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; abrupt smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

BA—15 to 20 inches; dark brown (10YR 3/3) loam; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw—20 to 27 inches; brown (10YR 4/3) loam; weak medium and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

BC—27 to 38 inches; dark yellowish brown (10YR 4/4) fine sandy loam; very weak medium and fine subangular blocky structure; very friable; medium acid; gradual smooth boundary.

2C1—38 to 47 inches; yellowish brown (10YR 5/4) loamy fine sand; single grain; loose; medium acid; gradual smooth boundary.

2C2—47 to 60 inches; yellowish brown (10YR 5/4 and 5/6) loamy fine sand; single grain; loose; medium acid.

The solum ranges from 30 to 48 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam or silt loam. The BA horizon has value of 3 or 4. The Bw horizon has value and chroma of 3 to 6. It is loam or sandy loam. The 2C horizon has value of 4 or 5 and chroma of 3 to 6. It is loamy fine sand or sand. In some pedons narrow bands of iron and clay accumulations and thin lenses of silt loam are below a depth of 50 inches.

Brady Series

The Brady series consists of somewhat poorly drained, moderately rapidly permeable soils on foot slopes, in outwash areas on uplands, and on stream terraces. These soils formed in loamy material overlying sandy glaciofluvial deposits. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. The native vegetation was deciduous trees and prairie grasses. Slope ranges from 1 to 4 percent.

Typical pedon of Brady sandy loam, 1 to 4 percent slopes, in a cultivated field; 2,000 feet south and 1,420 feet west of the northeast corner of sec. 1, T. 83 N., R. 3 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) mixed with some yellowish brown (10YR 5/4) dry; weak medium and fine granular structure; friable; neutral; abrupt smooth boundary.

BE—8 to 15 inches; dark brown (7.5YR 4/2) sandy loam, pale brown (10YR 6/3) dry; weak thin platy structure parting to very fine subangular blocky; friable; few distinct brown (7.5YR 5/4) coatings on faces of peds; few very dark concretions of iron oxide; neutral; clear smooth boundary.

Bt1—15 to 23 inches; brown (10YR 4/3) sandy loam; common medium distinct dark brown (7.5YR 4/2) mottles; weak medium and fine subangular blocky structure; friable; few faint clay films on faces of peds and clay bridges between sand grains; slightly acid; gradual smooth boundary.

Bt2—23 to 31 inches; brown (10YR 5/3) sandy loam; few medium and fine distinct strong brown (7.5YR 5/6) and few fine distinct dark brown (7.5YR 4/2) mottles; weak medium and fine subangular blocky structure; friable; few faint clay films on faces of peds and clay bridges between sand grains; slightly acid; gradual smooth boundary.

Bt3—31 to 39 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) sandy loam; weak medium and fine subangular blocky structure; friable; few faint clay films on faces of peds and clay bridges between sand grains; strongly acid; clear smooth boundary.

2BC—39 to 48 inches; mottled light gray (10YR 7/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/8) loamy sand; very weak medium subangular blocky structure; very friable; few fine dark concretions of iron oxide; strongly acid; abrupt wavy boundary.

2C1—48 to 54 inches; light brownish gray (10YR 6/2) sand; single grain; loose; medium acid; gradual smooth boundary.

2C2—54 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; medium acid.

The solum ranges from 40 to 70 inches in thickness. The content of coarse fragments ranges from 0 to 25 percent by volume throughout the solum.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. The BE horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. Some pedons have an E horizon. The A and E horizons are sandy loam, fine sandy loam, loamy fine sand, or loamy sand. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is commonly sandy loam or gravelly sandy loam, but the range includes sandy clay loam, loam, and clay loam. The BC horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 4. It is sandy loam or loamy sand. The 2C horizon has value of 5 or 6 and chroma of 1 to 4. It is commonly sand, but the range includes gravelly coarse sand and stratified coarse sand and gravel.

Chaseburg Series

The Chaseburg series consists of well drained, moderately permeable soils on bottom land, on alluvial fans, and in upland drainageways. These soils formed in recently deposited silty alluvium. The native vegetation was deciduous trees. Slope ranges from 0 to 5 percent.

Typical pedon of Chaseburg silt loam, 0 to 2 percent slopes, in a cultivated field; 980 feet west and 520 feet south of the center of sec. 16, T. 86 N., R. 3 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) and pale brown (10YR 6/3) dry; streaks and pockets of very dark grayish brown (10YR 3/2); weak fine granular structure; friable; mildly alkaline; abrupt smooth boundary.

C1—10 to 21 inches; dark grayish brown (10YR 4/2) silt loam; some thin very dark grayish brown (10YR 3/2) and brown (10YR 5/3) strata; massive with weak bedding planes resulting largely from stratification during deposition; friable; neutral; gradual smooth boundary.

C2—21 to 34 inches; dark grayish brown (10YR 4/2) silt loam; many thin grayish brown (10YR 5/2) and pale brown (10YR 6/3) strata; massive with weak bedding planes resulting largely from stratification during deposition; friable; neutral; gradual smooth boundary.

C3—34 to 46 inches; dark grayish brown (10YR 4/2) silt loam; many thin and very thin grayish brown (10YR 5/2) and very dark grayish brown (10YR 3/2) strata; massive with weak bedding planes resulting largely from stratification during deposition; friable; few dark soft accumulations of iron and manganese oxide in pores and strata below a depth of 40 inches; neutral; gradual smooth boundary.

C4—46 to 60 inches; dark grayish brown (10YR 4/2) silt loam; some thick very dark grayish brown (10YR 3/2) and thin pale brown (10YR 6/3) strata; massive with weak bedding planes resulting largely from stratification during deposition; few dark soft accumulations of iron and manganese oxide; friable; neutral.

The color, arrangement, and thickness of all horizons vary because the source of the parent material and the pattern of deposition differ from area to area. The average content of clay in the control section ranges from 10 to 18 percent. The Ap horizon has value of 3 to 5. It is commonly silt loam, but the range includes fine sandy loam. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4.

Chelsea Series

The Chelsea series consists of excessively drained, rapidly permeable soils on uplands and high stream benches. These soils formed in eolian sand. The native vegetation was deciduous trees. Slope ranges from 2 to 30 percent.

Typical pedon of Chelsea loamy fine sand, 5 to 9 percent slopes, in hardwood timber; 800 feet east and 1,200 feet north of the center of sec. 31, T. 85 N., R. 4 W.

A—0 to 3 inches; very dark gray (10YR 3/1) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure parting to single grain; very friable; some decomposed leaf litter; neutral; clear smooth boundary.

E1—3 to 11 inches; dark grayish brown (10YR 4/2) fine sand, light brownish gray (10YR 6/2) dry; single grain; very friable; slightly acid; gradual smooth boundary.

E2—11 to 19 inches; brown (10YR 4/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; slightly acid; gradual smooth boundary.

E3—19 to 31 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; medium acid; gradual smooth boundary.

E&Bt—31 to 60 inches; pale brown (10YR 6/3) fine sand; single grain; loose; ¼-inch to 2-inch lamellae of brown (7.5YR 4/4) sandy loam at depths of 36, 43, 49, 53, 56, and 60 inches; strongly acid.

The solum ranges from 4 to 7 feet in thickness. In uneroded areas the A horizon has chroma of 1 or 2. In cultivated or eroded areas, it varies considerably in thickness and color and has value of 3 or 4 and chroma of 2 or 3. It is typically loamy fine sand, but the range includes fine sand. The E horizon has chroma of 2 to 4 in the upper part and value of 4 to 6 in the lower part. The E&Bt horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 6. It has lamellae of sandy loam ¼ inch to 2 inches thick.

Clyde Series

The Clyde series consists of poorly drained, moderately permeable soils in upland drainageways and on lower, concave foot slopes. These soils formed in loamy glacial outwash or erosional sediments and in the underlying glacial till. A band of pebbles commonly separates the glacial till and the overlying material. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Clyde silty clay loam, 0 to 2 percent slopes, in a cultivated field; 2,240 feet west and 60 feet north of the center of sec. 23, T. 86 N., R. 4 W.

Ap—0 to 7 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; few fine roots; neutral; abrupt smooth boundary.

A—7 to 13 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and very fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

AB—13 to 17 inches; very dark gray (10YR 3/1) and black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine and very fine subangular blocky structure; friable; few fine roots; neutral; clear smooth boundary.

Bg1—17 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay loam; moderate medium and fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.
Bg2—23 to 28 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct olive yellow (2.5Y 6/6) and prominent yellowish brown (10YR 5/8) mottles; moderate medium and fine subangular blocky structure; friable; few fine roots; neutral; abrupt wavy boundary.
2Bg3—28 to 32 inches; light brownish gray (2.5Y 6/2) loam; many fine prominent yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; friable; few fine dark soft accumulations of manganese oxide; few fine pebbles; neutral; clear wavy boundary.
2BC—32 to 50 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/8) loam; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few fine pebbles; neutral; gradual smooth boundary.
2C—50 to 60 inches; mottled gray (5Y 5/1) and strong brown (7.5YR 5/8) loam; massive; firm; few fine calcium accumulations of carbonate; few fine pebbles; strong effervescence; mildly alkaline.

The thickness of the solum is typically more than 42 inches but ranges from 30 to 60 inches. The A horizon is typically clay loam or silty clay loam, but the range includes silt loam and loam. The upper part of the Bg horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The lower part of the Bg horizon and the BC and 2C horizons have hue of 7.5YR to 5Y, value of 5 or 6, and chroma of 1 to 8. The B and C horizons are silty clay loam, silt loam, loam, or clay loam that has layers of sandy loam.

Coland Series

The Coland series consists of poorly drained, moderately permeable soils on bottom land. These soils formed in loamy alluvium. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 3 percent.

Typical pedon of Coland clay loam, in an area of Spillville-Coland complex, 0 to 2 percent slopes, in a cultivated field; 1,000 feet west and 1,060 feet north of the southeast corner of sec. 11, T. 83 N., R. 3 W.

Ap—0 to 6 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine roots; neutral; abrupt smooth boundary.
A1—6 to 16 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine roots; neutral; abrupt smooth boundary.
A2—16 to 33 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; moderate fine and very fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.
AC—33 to 40 inches; very dark gray (N 3/0) clay loam, very dark gray (10YR 3/1) dry; weak fine prismatic structure parting to moderate fine and very fine subangular blocky; friable; few fine roots; neutral; gradual smooth boundary.
Cg1—40 to 50 inches; dark gray (5Y 4/1) clay loam; moderate fine prismatic structure; firm; few fine roots; neutral; gradual smooth boundary.
Cg2—50 to 60 inches; mottled light brownish gray (2.5Y 6/2) and dark gray (5Y 4/1) sandy clay loam; moderate fine prismatic structure; firm; few fine dark soft accumulations of iron and manganese oxide; neutral.

The solum ranges from 32 to 48 inches in thickness. The mollic epipedon is 36 or more inches thick.

The A horizon has hue of 10YR to 5Y and value of 2 to 4, or it is neutral in hue and has value of 2 or 3 and chroma of 0. It is commonly clay loam, but the range includes silty clay loam and loam. The C horizon has hue of 2.5Y or 5Y, value of 2 to 5, and chroma of 1 or less, or it is neutral in hue and has value of 2 or 3.

Colo Series

The Colo series consists of poorly drained, moderately permeable soils on flood plains and in upland drainageways. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, in a cultivated field; 2,600 feet south and 40 feet east of the northwest corner of sec. 7, T. 83 N., R. 3 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.
Al—9 to 15 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.
A2—15 to 23 inches; black (N 2/0) silty clay loam, black

(10YR 2/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

A3—23 to 29 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

AB—29 to 39 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine prismatic structure parting to moderate fine angular and subangular blocky; friable; few fine fibrous roots to a depth of 32 inches and few very fine fibrous roots below a depth of 32 inches; neutral; diffuse smooth boundary.

Bg—39 to 49 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine prismatic structure; firm; neutral; diffuse smooth boundary.

Cg1—49 to 58 inches; dark gray (10YR 4/1) silty clay loam; appears massive but has some vertical cleavage; friable; common fine prominent dark reddish brown (5YR 3/3) soft accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Cg2—58 to 60 inches; mottled light olive gray (5Y 6/2), dark gray (10YR 4/1), and light brownish gray (2.5Y 6/2) silty clay loam; massive; friable; common fine distinct yellowish brown (10YR 5/8) and brown (7.5YR 4/4) soft accumulations of iron and manganese oxide; neutral.

The solum ranges from 36 to 60 inches in thickness. The mollic epipedon is 36 or more inches thick. Some pedons have stratified silty overwash sediments 6 to 18 inches thick. These sediments have hue of 10YR, value of 3 to 5, and chroma of 1 or 2. The A horizon has hue of 10YR or 5Y and value of 2 or 3, or it is neutral in hue and has value of 2 or 3 and chroma of 0. Some pedons have an AC horizon. The Bg horizon has value of 2 or 3. The Cg horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 2 or less. It is silty clay loam, silt loam, or clay loam.

Curran Series

The Curran series consists of somewhat poorly drained soils on stream terraces. These soils formed in silty sediments and the underlying weakly stratified sand and fine sand. Permeability is moderate in the upper part of the profile and rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

The Curran soils in this county are taxadjuncts because they do not have the clay increase in the argillic horizon that is definitive for the series.

Typical pedon of Curran silt loam, 0 to 2 percent slopes, in a cultivated field; 180 feet north and 2,540 feet west of the southeast corner of sec. 14, T. 85 N., R. 3 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E—9 to 13 inches; dark grayish brown (10YR 4/2) mixed with some very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak medium platy structure parting to weak very fine subangular blocky; friable; few faint pale brown (10YR 6/3 dry) silt coatings on faces of peds; neutral; clear smooth boundary.

BE—13 to 17 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; few faint pale brown (10YR 6/3 dry) silt coatings on faces of peds; neutral; gradual smooth boundary.

Bt1—17 to 22 inches; brown (10YR 4/3) silt loam; few fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak medium and fine subangular blocky structure; friable; few faint clay films on faces of peds; few faint very pale brown (10YR 7/3 dry) silt coatings on faces of peds; few fine dark soft accumulations of iron and manganese oxide; neutral; gradual smooth boundary.

Bt2—22 to 27 inches; brown (10YR 4/3) silt loam; many fine distinct yellowish brown (10YR 5/8) and common fine distinct grayish brown (10YR 5/2 and 2.5Y 5/2) mottles; moderate medium and fine subangular blocky structure; friable; few faint clay films on faces of peds; few faint very pale brown (10YR 7/3 dry) silt coatings on faces of peds; few fine dark soft accumulations of iron and manganese oxide; slightly acid; gradual smooth boundary.

Bt3—27 to 33 inches; mottled light brownish gray (2.5Y 6/2), light olive brown (2.5Y 5/4), and yellowish brown (10YR 5/8) silt loam; moderate medium and fine angular and subangular blocky structure; friable; few faint clay films on faces of peds; few distinct light gray (10YR 7/1 dry) silt coatings on faces of peds; few fine dark soft accumulations of manganese oxide; neutral; clear smooth boundary.

Bt4—33 to 46 inches; mottled light brownish gray (2.5Y 6/2), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/8) silt loam; weak coarse prismatic structure parting to moderate medium and fine angular blocky; friable; few faint clay films on faces of peds; few distinct light gray (10YR 7/1 dry) silt coatings on faces of prisms and peds; few fine dark soft accumulations of manganese oxide; neutral; gradual wavy boundary.

2BC—46 to 58 inches; mottled pale brown (10YR 6/3) and yellowish brown (10YR 5/8) sandy loam; weak coarse prismatic structure; very friable; neutral; gradual wavy boundary.

2C—58 to 60 inches; mottled pale brown (10YR 6/3) and yellowish brown (10YR 5/8) sand; single grain; loose; neutral.

The solum ranges from 45 to 60 inches in thickness. The Ap or A horizon has value and chroma of 1 to 3. The E and BE horizons have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. The Bt horizon has hue of 2.5Y or 10YR and value of 4 to 6. It is silt loam or silty clay loam. The 2BC and the 2C horizons have hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 2 to 6. They are commonly stratified sandy loam, loam, or silt loam that has bands or pockets of sand.

Dells Series

The Dells series consists of somewhat poorly drained soils on stream terraces. These soils formed in silty sediments and in the underlying sandy deposits. Permeability is moderate in the upper part of the profile and rapid in the sandy substratum. The native vegetation was mixed deciduous trees and prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Dells silt loam, 0 to 2 percent slopes, in a cultivated field; 290 feet east and 280 feet north of the center of sec. 28, T. 84 N., R. 3 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine fibrous roots; neutral; abrupt smooth boundary.

E—9 to 16 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; very weak thin platy structure parting to weak fine granular; friable; some very dark grayish brown (10YR 3/2) coatings on faces of peds and in root channels; few very fine fibrous roots; neutral; clear wavy boundary.

Bt1—16 to 22 inches; brown (10YR 5/3) silty clay loam; common fine distinct dark grayish brown (10YR 4/2) and few fine distinct brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; few very fine fibrous roots; neutral; gradual smooth boundary.

Bt2—22 to 31 inches; brown (10YR 5/3) silty clay loam; common fine distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; few distinct clay films on faces of peds; slightly acid; clear smooth boundary.

2Bt3—31 to 36 inches; light brownish gray (10YR 6/2) and pale brown (10YR 6/3) sandy loam; common medium distinct strong brown (7.5YR 5/6) and common fine distinct brown (7.5YR 4/4) mottles; weak medium and fine subangular blocky structure; very friable; few distinct clay films on faces of peds and clay bridges between sand grains; neutral; gradual wavy boundary.

2C—36 to 60 inches; brown (10YR 5/3) loamy sand; thin strata of sand; many medium and coarse distinct strong brown (7.5YR 5/6), many coarse distinct brown (7.5YR 4/4), and few coarse prominent light brownish gray (2.5Y 6/2) mottles; massive; very friable; few medium and fine dark soft accumulations of manganese oxide; neutral.

The thickness of the solum ranges from 20 to 36 inches and commonly is the same as the thickness of the silty deposit over the sandy material. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have a BE horizon. The E or BE horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 5. It is silt loam or silty clay loam in which the content of clay ranges from 20 to 30 percent. The 2Bt horizon has colors similar to those of the Bt horizon. It is sandy loam, loam, or sandy clay loam. The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 8, and chroma of 2 to 4. It is loamy sand or sand, but some pedons have thin strata of sandy loam, loam, or silt loam.

Dickinson Series

The Dickinson series consists of somewhat excessively drained, moderately rapidly permeable soils on uplands and stream terraces. These soils formed in glacial or alluvial deposits that have been reworked by wind. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Dickinson fine sandy loam, 2 to 5 percent slopes, in a cultivated field; 1,800 feet west and 1,560 feet south of the northeast corner of sec. 1, T. 85 N., R. 4 W.

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

A—7 to 18 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; few fine fibrous roots; neutral; gradual smooth boundary.

Bw1—18 to 27 inches; brown (10YR 4/3) fine sandy loam; weak fine subangular blocky structure; very friable; few fine fibrous roots; slightly acid; clear smooth boundary.

Bw2—27 to 35 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

BC—35 to 42 inches; yellowish brown (10YR 5/4) loamy fine sand; few medium distinct brown (7.5YR 4/4) mottles; very weak fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) loamy fine sand; few medium distinct brown (7.5YR 4/4) mottles; single grain; loose; slightly acid.

The thickness of the solum ranges from 24 to 50 inches. The depth to loamy sand and sand ranges from 20 to 42 inches.

The A horizon has value of 2 or 3. It has chroma of 1 or 2 in the upper part and chroma of 2 or 3 in the lower part. It is fine sandy loam, sandy loam, or loam. The Bw horizon typically has value of 3 or 4 and chroma of 2 or 3 in the upper part and value of 4 or 5 and chroma of 4 to 6 in the lower part. It is typically fine sandy loam or sandy loam. The BC and C horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. They are typically loamy fine sand, loamy sand, fine sand, or sand, but loamy substratum phases are within the range.

Dinsdale Series

The Dinsdale series consists of well drained, moderately permeable soils on uplands. These soils formed in about 24 to 40 inches of loess and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Dinsdale silt loam, 2 to 5 percent slopes, in a cultivated field; 2,000 feet east and 275 feet north of the southwest corner of sec. 28, T. 83 N., R. 2 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; many fine roots; neutral; abrupt smooth boundary.

A1—7 to 12 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; common medium and fine roots; neutral; clear smooth boundary.

A2—12 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; common medium and fine roots; slightly acid; clear smooth boundary.

BA—16 to 20 inches; dark brown (10YR 3/3) silty clay loam; some streaks and pockets of brown (10YR 4/3); moderate fine subangular blocky structure; friable; few medium and fine roots; medium acid; gradual smooth boundary.

Bt1—20 to 24 inches; brown (10YR 4/3) silty clay loam; moderate medium and fine subangular blocky structure; friable; few faint clay films on faces of peds; few fine roots; medium acid; clear smooth boundary.

Bt2—24 to 30 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium prismatic structure parting to moderate medium and fine angular and subangular blocky; friable; few faint clay films on faces of prisms and peds; few fine roots; slightly acid; clear smooth boundary.

2Bt3—30 to 40 inches; dark yellowish brown (10YR 4/4) loam; few medium prominent strong brown (7.5YR 5/6) and brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium and fine angular blocky; firm; few faint clay films on faces of prisms and peds; some dark brown (7.5YR 3/2) coatings on faces of peds; very few fine roots; few fine pebbles; neutral; gradual smooth boundary.

2BC—40 to 46 inches; yellowish brown (10YR 5/4) loam; common fine prominent strong brown (7.5YR 5/6) and common fine faint brown (7.5YR 5/4) mottles; weak coarse prismatic structure; firm; very few fine roots; few fine pebbles; neutral; abrupt wavy boundary.

2C—46 to 60 inches; yellowish brown (10YR 5/4) loam grading with depth to light yellowish brown (10YR 6/4); many fine prominent strong brown (7.5YR 5/6), common fine distinct brown (7.5YR 4/4), and few medium distinct strong brown (7.5YR 5/8) mottles;

massive; firm; few fine dark soft accumulations of manganese oxide; few medium and fine pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 42 to 60 inches. The loess ranges from 24 to 40 inches in thickness. The depth to carbonates ranges from 45 to 60 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or silty clay loam. The content of clay in this horizon ranges from 25 to 29 percent. The Bt horizon has value and chroma of 3 or 4. The content of clay in this horizon ranges from 30 to 34 percent. The 2Bt and 2C horizons have hue of 10YR or 7.5YR and chroma of 4 to 8. They are typically loam, but range to sandy clay loam or clay loam.

The Dinsdale soil in map unit 377C2 is a taxadjunct because it has a dark surface layer that is thinner than is defined as the range for the series.

Downs Series

The Downs series consists of well drained, moderately permeable soils on uplands and stream benches. These soils formed in loess. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 2 to 14 percent.

Typical pedon of Downs silt loam, 5 to 9 percent slopes, in a cultivated field; 470 feet west and 20 feet north of the southeast corner of sec. 17, T. 86 N., R. 1 W.

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

Bt1—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam (26 percent clay), brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; many distinct dark grayish brown (10YR 4/2) coatings and clay films on faces of peds; few fine fibrous roots; slightly acid; clear smooth boundary.

Bt2—13 to 23 inches; dark yellowish brown (10YR 4/4) silty clay loam (28 percent clay); moderate fine angular and subangular blocky structure; friable; few distinct clay films on faces of peds; few faint very pale brown (10YR 7/3 dry) silt coatings on faces of peds in the lower part; few fine fibrous roots; medium acid; gradual smooth boundary.

Bt3—23 to 33 inches; dark yellowish brown (10YR 4/4) silty clay loam (28 percent clay); moderate fine angular and subangular blocky structure; friable; few distinct clay films and few faint very pale brown (10YR 7/3) dry silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bt4—33 to 40 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); moderate fine angular and subangular blocky structure; friable; few faint clay films and few faint very pale brown (10YR 7/3) dry silt coatings on faces of peds; few fine dark soft accumulations of manganese oxide; medium acid; gradual smooth boundary.

BC—40 to 49 inches; yellowish brown (10YR 5/4) silt loam (26 percent clay); weak coarse prismatic structure; friable; few faint very pale brown (10YR 7/3 dry) silt coatings on faces of peds; common fine and very fine dark soft accumulations of manganese oxide; medium acid; gradual smooth boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) silt loam (22 percent clay); appears massive but has some vertical cleavage; friable; few fine dark soft accumulations of manganese oxide; slightly acid.

The solum ranges from 42 to 70 inches in thickness. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an E or BE horizon, which has value of 3 or 4 and chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. The content of clay in this horizon ranges from 26 to 35 percent.

Dubuque Series

The Dubuque series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in a thin layer of residuum over limestone bedrock. The native vegetation was deciduous trees. Slope ranges from 5 to 25 percent.

Typical pedon of Dubuque silt loam, 14 to 25 percent slopes, in an area of hardwood timber; 350 feet south and 800 feet west of the northeast corner of sec. 5, T. 85 N., R. 2 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, light gray (10YR 7/2) dry; weak fine granular structure; friable; some thin very dark gray (10YR 3/1) coatings on faces of peds; medium acid; abrupt smooth boundary.

E1—2 to 6 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; moderate thin platy structure; friable; slightly acid; clear smooth boundary.

E2—6 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak thin platy structure parting to weak fine granular; friable; strongly acid; gradual smooth boundary.

BE—10 to 14 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; friable; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—14 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium and fine angular and subangular blocky structure; friable; few distinct clay films on faces of peds; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

2Bt2—34 to 38 inches; brown (7.5YR 4/4) silty clay; moderate medium and fine angular blocky structure; very firm; few distinct clay films on faces of peds; few thin reddish brown (5YR 4/4) coatings on faces of peds; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; about 10 percent coarse chert fragments; strongly acid; clear smooth boundary.

2R—38 inches; hard, level-bedded limestone bedrock that is fragmented in the upper part; small amounts of reddish brown (5YR 4/4) and yellowish red (5YR 4/6) clayey material between fragments in the upper part.

The solum ranges from 20 to 40 inches in thickness and corresponds with the depth to limestone bedrock. The A horizon has chroma of 1 or 2. The Ap horizon, if it occurs, has value of 4 or 5 and chroma of 2 or 3. The E horizon has value of 4 or 5 and chroma of 2 or 3. The A and E horizons typically are silt loam, but the range includes silty clay loam. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is silty clay loam or silt loam. The content of clay in this horizon ranges from 26 to 35 percent. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or higher, and chroma of 3 or higher. It is silty clay loam, silty clay, or clay.

Ely Series

The Ely series consists of somewhat poorly drained, moderately permeable soils on foot slopes, in upland drainageways, and on alluvial fans. These soils formed in silty local alluvium or colluvium. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Typical pedon of Ely silty clay loam, 2 to 5 percent slopes, in a cultivated field; 200 feet west and 1,925 feet north of the southeast corner of sec. 20, T. 86 N., R. 1 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) and dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

A1—8 to 13 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

A2—13 to 19 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

BA—19 to 26 inches; very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine and very fine subangular blocky structure; friable; few very fine fibrous roots; neutral; clear smooth boundary.

Bw1—26 to 34 inches; grayish brown (10YR 5/2) silty clay loam; few fine prominent brown (7.5YR 4/4) and strong brown (7.5YR 5/6) and common fine faint yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; dark grayish brown (10YR 4/2) coatings on faces of peds and root channels; neutral; gradual smooth boundary.

Bw2—34 to 43 inches; brown (10YR 5/3) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3), few medium distinct brown (7.5YR 4/4), and few fine distinct yellowish brown (10YR 5/8) mottles; moderate medium and fine subangular blocky structure; friable; light gray (10YR 7/1 dry) silt coatings; many fine dark soft accumulations of manganese oxide; concentration of yellowish red (5YR 5/6) and reddish yellow (7.5YR 6/8) mottles and concretions of iron oxide at a depth of 34 to 39 inches; neutral; clear smooth boundary.

BC—43 to 51 inches; mottled brown (10YR 5/3) and light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; friable; some fine dark soft accumulations of iron and manganese oxide; neutral; clear smooth boundary.

C—51 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; appears massive but has some vertical cleavage; friable; neutral.

The solum is generally more than 48 inches thick but ranges from 40 to 70 inches in thickness. The A horizon ranges from 24 to 36 inches in thickness. It has value of 2 or 3 and chroma of 1 or 2. It is silt loam or silty clay loam. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. The content of clay in this horizon ranges from 28 to 35 percent. The C horizon is silt loam, silty clay loam, or loam.

Emeline Series

The Emeline series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in 4 to 12 inches of loamy material over limestone bedrock (fig. 14). The native vegetation was prairie grasses and hardwoods. Slope ranges from 2 to 18 percent.

Typical pedon of Emeline loam, 2 to 9 percent slopes, in a bluegrass pasture; 400 feet west and 2,040 feet north of the southeast corner of sec. 10, T. 86 N., R. 3 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; many fine and very fine roots; few fragments of weathered limestone in the lower part; neutral; abrupt wavy boundary.

2R—9 inches; level-bedded, hard, fragmented limestone bedrock containing about 5 percent black (10YR 2/1) loamy material.

The thickness of the solum and the depth to bedrock range from 4 to 12 inches. The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. It is loam, silt loam, or clay loam.

Figure 14.—The limestone bedrock underlying Emeline soils.

Exette Series

The Exette series consists of well drained, moderately permeable soils on uplands. These soils formed in loess. The native vegetation was deciduous trees. Slope ranges from 9 to 25 percent.

Typical pedon of Exette silt loam, 18 to 25 percent slopes, moderately eroded, in a previously cultivated field; 1,000 feet west and 400 feet north of the southeast corner of sec. 1, T. 84 N., R. 3 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; streaks and pockets of yellowish brown (10YR 5/4); weak fine subangular blocky structure parting to weak fine granular; friable; many fine fibrous roots; neutral; abrupt smooth boundary.

Bw1—7 to 11 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; few fine distinct yellowish brown (10YR 5/6) and few fine prominent light brownish gray (2.5Y 6/2) mottles; weak medium and fine subangular blocky structure; friable; many fine fibrous roots; few fine dark soft accumulations of manganese oxide; neutral; clear smooth boundary.

Bw2—11 to 17 inches; yellowish brown (10YR 5/4) silt loam; common fine prominent light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) and common medium distinct brown (7.5YR 5/4) mottles; moderate medium and fine angular and subangular blocky structure; friable; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; few fine fibrous roots; many medium and fine dark soft accumulations of manganese oxide; neutral; clear smooth boundary.

Bw3—17 to 23 inches; mottled light brownish gray (2.5Y 6/2), brown (7.5YR 5/4), and yellowish brown (10YR 5/6) silt loam; moderate medium and fine angular blocky structure; friable; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; few fine fibrous roots; slightly acid; clear smooth boundary.

BC—23 to 33 inches; light brownish gray (2.5Y 6/2) silt loam; many medium and fine prominent yellowish brown (10YR 5/6 and 5/8) and few very fine prominent brown (7.5YR 5/4) mottles; weak fine angular and subangular blocky structure; friable; neutral; clear smooth boundary.

C—33 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent yellowish red (5YR 5/8) and strong brown (7.5YR 5/8) mottles; massive; very friable; common large coarse yellowish red (5YR 5/8) accumulations of iron and manganese oxide; neutral.

The solum ranges from 30 to 55 inches in thickness. The Ap horizon has chroma of 2 or 3. In uncultivated areas the A horizon has chroma of 1 or 2. The E horizon, if it occurs, has value of 4 or 5. The Bw and BC horizons have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. The C horizon has value of 5 or 6. Common to many mottles are within a depth of 30 inches. They have hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 8. These mottles are interpreted to be relict and are not related to the present soil moisture regime.

Fayette Series

The Fayette series consists of well drained, moderately permeable soils on uplands and stream benches. These soils formed in loess. The native vegetation was deciduous trees. Slope ranges from 2 to 40 percent.

Typical pedon of Fayette silt loam, 5 to 9 percent slopes, in a wooded area; 740 feet west and 260 feet south of the center of sec. 14, T. 84 N., R. 4 W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam (14 percent clay), light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; medium acid; clear smooth boundary.

E—3 to 9 inches; dark grayish brown (10YR 4/2) silt loam (13 percent clay), light gray (10YR 7/2) dry; weak thin platy structure; friable; medium acid; clear smooth boundary.

BE—9 to 14 inches; yellowish brown (10YR 5/4) silt loam (20 percent clay); weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt1—14 to 35 inches; yellowish brown (10YR 5/4) silty clay loam (32 percent clay); moderate medium prismatic structure parting to moderate medium and fine subangular and angular blocky; friable; few distinct clay films on faces of peds; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt2—35 to 41 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); moderate medium prismatic structure parting to moderate medium and fine subangular and angular blocky; friable; few distinct clay films on faces of peds; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

BC—41 to 46 inches; yellowish brown (10YR 5/4) silty clay loam (27 percent clay); few fine prominent light brownish gray (2.5Y 6/2) and common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular and angular blocky; friable; strongly acid; gradual smooth boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) silt loam (26 percent clay); few fine prominent light brownish gray (2.5Y 6/2) mottles; appears massive but has some vertical cleavage; friable; strongly acid.

The solum ranges from 40 to 60 inches in thickness. The A horizon has value of 2 to 4 and chroma of 1 or 2. The E horizon has value of 4 or 5 and chroma of 1 to 4. In some cultivated areas it is incorporated into the Ap horizon. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The content of clay in this horizon ranges from 28 to 35 percent. The BC and C horizons are silt loam or silty clay loam. They have value of 4 or 5.

Finchford Series

The Finchford series consists of excessively drained, very rapidly permeable soils on stream terraces. These soils formed in coarse textured alluvium. The native vegetation was drought-tolerant prairie grasses. Slope ranges from 0 to 9 percent.

Typical pedon of Finchford loamy sand, 0 to 2 percent slopes, in a cultivated field; 85 feet west and 580 feet south of the northeast corner of sec. 3, T. 83 N., R. 3 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loamy sand, very dark grayish brown (10YR 3/2) dry; very weak fine granular structure; very friable; few fine fibrous roots; few fine pebbles; neutral; abrupt smooth boundary.

A—9 to 20 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; very weak medium and fine subangular blocky structure; very friable; few fine pebbles; neutral; gradual smooth boundary.

Bw1—20 to 35 inches; dark brown (7.5YR 3/2) sand; single grain; loose; about 5 percent gravel; medium acid; gradual smooth boundary.

Bw2—35 to 42 inches; dark brown (10YR 3/3) sand; single grain; loose; about 5 percent gravel; medium acid; clear smooth boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 10 percent gravel; medium acid.

The solum ranges from 24 to 48 inches in thickness. In the solum, the content of sand is 30 to 60 percent and the content of coarse or very coarse sand is 20 to 35 percent. The content of gravel is 3 to 25 percent, by volume, but ranges to 35 percent in individual horizons.

The A horizon is loamy sand or sand. It has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. It is loamy sand or sand. The C horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 or 5.

Flagler Series

The Flagler series consists of somewhat excessively drained soils on stream terraces. These soils formed in 2 to 3 feet of moderately coarse textured alluvium and in loamy sand and sand that contain some gravel. Permeability is moderately rapid in the upper part of the profile and very rapid in the coarse textured material. The native vegetation was prairie grasses. Slope ranges from 1 to 5 percent.

Typical pedon of Flagler sandy loam, 1 to 5 percent slopes, in a cultivated field; 1,600 feet west and 920 feet north of the southeast corner of sec. 1, T. 83 N., R. 3 W.

Ap—0 to 7 inches; black (10YR 2/1) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

A1—7 to 14 inches; black (10YR 2/1) sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; few fine fibrous roots; medium acid; gradual smooth boundary.

A2—14 to 20 inches; very dark brown (10YR 2/2) sandy loam, brown (10YR 5/3) dry; weak medium and fine subangular blocky structure parting to weak fine granular; very friable; few fine fibrous roots; slightly acid; clear smooth boundary.

Bw1—20 to 24 inches; dark brown (10YR 3/3) sandy loam; weak medium and fine subangular blocky structure; very friable; very few fine fibrous roots; slightly acid; clear smooth boundary.

Bw2—24 to 29 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; very few fine fibrous roots; medium acid; gradual smooth boundary.

2BC—29 to 42 inches; yellowish brown (10YR 5/4 and 5/6) loamy sand; very weak medium subangular blocky structure; very friable; few distinct brown (7.5YR 4/4) clay bridges between sand grains; few fine pebbles; medium acid; gradual smooth boundary.

2C—42 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 10 percent gravel; neutral.

The thickness of the solum typically is 24 to 40 inches, but it ranges from 20 to 50 inches. The depth to contrasting textures ranges from 20 to 36 inches and is quite variable within short distances.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is commonly sandy loam or fine sandy loam. The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. The 2C horizon has value and chroma of 4 to 6. The content of gravel in this horizon typically is 5 to 15 percent, but in some strata it may be between 20 and 50 percent.

Floyd Series

The Floyd series consists of somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loamy stratified material and the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Typical pedon of Floyd loam, 1 to 4 percent slopes, in a cultivated field; 2,260 feet west and 400 feet south of the northeast corner of sec. 17, T. 86 N., R. 4 W.

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

A—7 to 15 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

AB—15 to 23 inches; very dark grayish brown (2.5Y 3/2) loam, grayish brown (2.5Y 5/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw1—23 to 28 inches; dark grayish brown (10YR 4/2) loam; common fine distinct dark yellowish brown (10YR 4/4) mottles throughout and many fine distinct light olive brown (2.5Y 5/4) mottles in the lower part; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw2—28 to 32 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) sandy clay loam; many fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; few dark soft accumulations of iron and manganese oxide; few fine pebbles; neutral; clear smooth boundary.

Bw3—32 to 41 inches; olive brown (2.5Y 4/4) sandy loam; common medium prominent yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; very friable; few fine pebbles; neutral; clear smooth boundary.

2Bw4—41 to 48 inches; mottled light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) loam; weak coarse prismatic structure parting to moderate fine subangular blocky; firm; few dark soft accumulations of iron and manganese oxide; few fine pebbles; neutral; clear smooth boundary.

2C—48 to 60 inches; mottled light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) loam; appears massive but has some vertical cleavage; firm; few fine pebbles; neutral.

The solum ranges from 40 to 60 inches in thickness. The depth to glacial till ranges from 30 to 45 inches and the depth to carbonates from 45 to 70 inches.

The A horizon typically is loam, but the range includes clay loam, silty clay loam, and silt loam. This horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 2.5Y, 10YR, or 7.5YR, value of 4 or 5, and chroma of 2 to 6. The 2Bw and 2C horizons are typically mottled with hue of 2.5Y, 10YR, or 7.5YR, value of 4 or 5, and chroma of 2 to 8. They are typically loam, but the range includes clay loam and sandy clay loam.

Franklin Series

The Franklin series consists of somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying glacial till. The native vegetation was deciduous trees and prairie grasses. Slope ranges from 1 to 4 percent.

Typical pedon of Franklin silt loam, 1 to 4 percent slopes, in a cultivated field; 1,020 feet west and 1,040 feet north of the southeast corner of sec. 31, T. 84 N., R. 4 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; cloddy parting to weak fine granular structure; friable; neutral; abrupt smooth boundary.

E—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam; grayish brown (10YR 5/2) dry; weak thin platy structure; friable; neutral; clear smooth boundary.

BE—11 to 19 inches; brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) and brown (10YR 5/3) dry; common very fine distinct yellowish brown (10YR 5/6) and common fine faint brown (10YR 5/3) mottles; weak fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bt1—19 to 24 inches; grayish brown (10YR 5/2) silty clay loam; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; few faint light gray (10YR 7/1 dry) silt and sand coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt2—24 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent light yellowish brown (10YR 6/4) and few fine prominent yellowish brown (10YR 5/8) mottles; moderate medium and fine subangular blocky structure; friable; few distinct clay films on faces of peds; few faint light gray (10YR 7/1 dry) silt coatings on faces of peds; medium acid; pebble band at a depth of about 32 inches; strongly acid; abrupt wavy boundary.

2BC—32 to 38 inches; light brownish gray (10YR 6/2) sandy clay loam; common fine distinct light yellowish brown (10YR 6/4) and strong brown (7.5YR 5/8) mottles; moderate medium and fine subangular blocky structure; friable; few fine pebbles; strongly acid; clear smooth boundary.

2C1—38 to 43 inches; yellowish brown (10YR 5/8) loam; common medium and fine distinct brown (7.5YR 4/4) mottles; appears massive but has some vertical cleavage; firm; few fine pebbles; medium acid; gradual smooth boundary.

2C2—43 to 60 inches; yellowish brown (10YR 5/8) loam; common fine distinct pale brown (10YR 6/3) mottles; appears massive but has some vertical cleavage; firm; common fine and very fine dark soft accumulations of manganese oxide; few fine pebbles; slightly acid.

The thickness of the loess ranges from 20 to 40 inches. The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 or 5. The upper part of the B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. The 2BC horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 8.

Garwin Series

The Garwin series consists of poorly drained, moderately permeable soils in drainageways and slight depressions in the uplands. These soils formed in loess. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Garwin silty clay loam, 0 to 2 percent slopes, in a cultivated field; 1,900 feet north and 100 feet east of the southwest corner of sec. 4, T. 86 N., R. 2 W.

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

A1—8 to 14 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate medium and fine granular; friable; many fine fibrous roots; slightly acid; gradual smooth boundary.

A2—14 to 19 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; many fine fibrous roots; slightly acid; clear smooth boundary.

BA—19 to 23 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine prominent olive brown (2.5Y 4/4) mottles; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

Bg1—23 to 27 inches; dark gray (10YR 4/1) silty clay loam; common fine prominent olive brown (2.5Y 4/4) mottles; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

Bg2—27 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine faint light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Bg3—34 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and few fine faint light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine dark soft accumulations of manganese oxide; neutral; gradual smooth boundary.

BCg—40 to 46 inches; grayish brown (2.5Y 5/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few fine dark soft accumulations of iron and manganese oxide; mildly alkaline; gradual smooth boundary.

Cg—46 to 60 inches; grayish brown (2.5Y 5/2) silt loam; moderate medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; few fine dark soft accumulations of iron and manganese oxide; mildly alkaline.

The solum ranges from 40 to 64 inches in thickness. The mollic epipedon is 18 to 24 inches thick.

The A horizon has hue of 10YR to 5Y or is neutral in hue. It has chroma of 0 or 1. The Ap horizon typically is silty clay loam, but the range includes silt loam. The Bg1 horizon has hue of 10YR or 2.5Y and value of 3 or 4. The Bg2 and Bg3 horizons have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. The BCg and Cg horizons have hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Granby Series

The Granby series consists of poorly drained, rapidly permeable soils in outwash areas and on stream terraces. These soils formed in sandy eolian and glaciofluvial deposits. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Granby fine sandy loam, 0 to 2 percent slopes, in a cultivated field; 520 feet west and 2,300 feet south of the northeast corner of sec. 1, T. 83 N., R. 3 W.

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

Bg1—10 to 15 inches; dark grayish brown (10YR 4/2) sand; weak coarse subangular blocky structure; very friable; neutral; clear smooth boundary.

Bg2—15 to 20 inches; dark gray (10YR 4/1) sand; weak coarse subangular blocky structure; very friable; neutral; clear smooth boundary.

Bg3—20 to 32 inches; grayish brown (2.5Y 5/2) sand; few fine distinct olive yellow (2.5Y 6/6) and few medium faint light brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure; very friable; neutral; gradual smooth boundary.

Bg4—32 to 40 inches; yellowish brown (10YR 5/6) sand; few fine faint brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; neutral; clear smooth boundary.

BCg—40 to 50 inches; mottled dark grayish brown (10YR 4/2), light olive brown (2.5Y 5/4), dark gray (10YR 4/1), and light brownish gray (2.5Y 6/2) sand; very weak coarse subangular blocky structure; very friable; neutral; gradual smooth boundary.

Cg—50 to 60 inches; gray (10YR 5/1) sand; common fine faint dark grayish brown (10YR 4/2) mottles; single grain; loose; neutral.

The thickness of the solum is 30 to 52 inches. The A horizon has hue of 10YR, or it is neutral in hue. It has value of 2 or 3. It is fine sandy loam, loamy fine sand, or sand. The Bg horizon has hue of 10YR or 2.5Y and value of 4 to 6. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7, and chroma of 1 to 4. Some pedons have gravelly sand or gravelly loamy sand in the C horizon.

Hayfield Series

The Hayfield series consists of somewhat poorly drained soils on stream terraces. These soils formed in 20 to 40 inches of loamy sediments overlying sandy and gravelly alluvial sediments. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was mixed deciduous trees and prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Hayfield loam, 0 to 2 percent slopes, in a cultivated field; 860 feet south and 2,240 feet west of the northeast corner of sec. 34, T. 86 N., R. 3 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

BE—8 to 12 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) loam, light brownish gray (10YR 6/2), pale brown (10YR 6/3), and grayish brown (10YR 5/2) dry; streaks and pockets of very dark gray (10YR 3/1); weak medium platy structure parting to weak very fine angular blocky; friable; neutral; abrupt wavy boundary.

Bt1—12 to 25 inches; brown (10YR 4/3) loam; common fine distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine angular and subangular blocky; friable; few distinct clay films on faces of prisms; few fine pebbles; strongly acid; gradual smooth boundary.

Bt2—25 to 30 inches; brown (10YR 5/3) loam; common fine distinct dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and strong brown (7.5YR 5/8) and few fine prominent yellowish red (5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium and fine angular and subangular blocky; friable; few distinct clay films on faces of prisms; few fine pebbles; strongly acid; abrupt wavy boundary.

2E&Bt—30 to 60 inches; brown (10YR 4/3) gravelly sand; many medium distinct yellowish red (5YR 5/8) and strong brown (7.5YR 5/8) mottles at a depth of 30 to 33 inches; very weak medium subangular blocky structure parting to single grain; loose; thin lamellae of dark grayish brown (10YR 4/2) sandy loam between depths of 40 and 54 inches; about 20 percent gravel; medium acid.

The solum ranges from 20 to 40 inches in thickness and corresponds to the depth to sand and gravel. The content of coarse fragments ranges from 0 to 5 percent in the upper part of the profile and from 2 to 35 percent in the 2E&Bt horizon.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. The E or BE horizon has value of 4 or 5 and chroma of 1 or 2. The A and E horizons, if they occur, are loam or silt loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. The upper part of the Bt horizon is loam or silt loam, and the lower part is loam, clay loam, or silt loam. Some pedons have a 2B or 2C horizon. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is coarse sand, gravelly sand, or sand.

Judson Series

The Judson series consists of well drained, moderately permeable soils on foot slopes and alluvial fans. These soils formed in silty local alluvium. The native vegetation was prairie grasses. Slope ranges from 1 to 9 percent.

Typical pedon of Judson silt loam, 1 to 5 percent slopes, in a cultivated field; 300 feet east and 500 feet north of the center of sec. 27, T. 85 N., R. 2 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; few fine fibrous roots; slightly acid; abrupt smooth boundary.

Al—8 to 20 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

A2—20 to 26 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

AB—26 to 34 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak medium and fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw1—34 to 44 inches; dark brown (10YR 3/3) silty clay loam; some very dark grayish brown (10YR 3/2) coatings in upper part; weak medium and fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw2—44 to 54 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium and fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

BC—54 to 60 inches; brown (10YR 4/3) silty clay loam; common medium distinct yellowish brown (10YR 5/4) and few fine distinct pale brown (10YR 6/3) mottles; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; few fine dark soft accumulations of iron and manganese oxide; slightly acid.

The solum ranges from 40 to more than 60 inches in thickness. The A horizon has chroma of 1 or 2. It is silt loam or silty clay loam. The Bw horizon has value of 3 to 5 and chroma of 3 or 4. The BC horizon has value of 3 to 5 and chroma of 3 or 4. It is typically silty clay loam, but the range includes silt loam.

Kenyon Series

The Kenyon series consists of moderately well drained, moderately permeable soils on uplands. These soils formed in loamy sediments and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Kenyon loam, 2 to 5 percent slopes, in a cultivated field; 465 feet west and 1,215 feet south of the center of sec. 20, T. 86 N., R. 4 W.

Ap—0 to 9 inches; black (10YR 2/1) loam (20 percent clay), dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

A—9 to 14 inches; black (10YR 2/1) loam (21 percent clay) grading to very dark brown (10YR 2/2) in the lower part, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw1—14 to 18 inches; brown (10YR 4/3) loam (21 percent clay); weak fine subangular blocky structure; friable; very dark grayish brown (10YR 3/2) coatings on faces of peds and in root channels; medium acid; gradual smooth boundary.

Bw2—18 to 23 inches; dark yellowish brown (10YR 4/4) loam (21 percent clay); moderate fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

Bw3—23 to 29 inches; yellowish brown (10YR 5/4) loam (22 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; discontinuous stone line at a depth of about 29 inches; medium acid; clear smooth boundary.

2Bw4—29 to 38 inches; yellowish brown (10YR 5/4) loam (23 percent clay); common fine prominent strong brown (7.5YR 5/6) and few fine distinct light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate fine angular and subangular blocky; firm; few fine pebbles; medium acid; gradual smooth boundary.

2Bw5—38 to 51 inches; mottled yellowish brown (10YR 5/4), grayish brown (2.5Y 5/2), and strong brown (7.5YR 5/6) loam (24 percent clay); weak coarse prismatic structure parting to moderate fine angular and subangular blocky; firm; few fine pebbles; medium acid; gradual smooth boundary.

2C—51 to 60 inches; mottled yellowish brown (10YR 5/4), light brownish gray (2.5Y 6/2), and strong brown (7.5YR 5/6) sandy clay loam (22 percent clay); massive; firm; few fine pebbles; neutral.

The thickness of the solum and the depth to carbonates range from 45 to 66 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is typically loam, but in some pedons it is silt loam. The Bw horizon has value of 4 or 5 and chroma of 3 to 6. The 2Bw horizon has value of 4 or 5 and chroma of 2 to 6. It is typically loam but ranges to clay loam and sandy clay loam in which the content of clay is less than 30 percent. The 2C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 6.

The Kenyon soil in map unit 83C2 is a taxadjunct because it has a dark surface layer that is thinner than is defined as the range for the series.

Klinger Series

The Klinger series consists of somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Typical pedon of Klinger silt loam, 1 to 4 percent slopes, in a cultivated field; 1,000 feet south and 120 feet east of the northwest corner of sec. 10, T. 85 N., R. 3 W.

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

A—8 to 14 inches; very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; clear smooth boundary.

BA—14 to 20 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; friable; some very dark grayish brown (10YR 3/2) coatings on faces of peds; few fine fibrous roots; neutral; gradual smooth boundary.

Bgl—20 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; streaks and pockets of brown (10YR 4/3); moderate medium and fine subangular blocky structure; friable; few fine fibrous roots; slightly acid; gradual smooth boundary.

Bg2—26 to 31 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/4 and 5/6) mottles; weak fine subangular blocky structure; friable; a stone line at a depth of about 31 inches; few fine fibrous roots; neutral; gradual smooth boundary.

2Bg3—31 to 41 inches; mottled yellowish brown (10YR 5/4 and 5/6) and grayish brown (2.5Y 5/2) loam; moderate medium prismatic structure parting to moderate medium and fine angular and subangular blocky; firm; few fine dark soft accumulations of manganese oxide; few fine pebbles; slightly acid; gradual smooth boundary.

2BC—41 to 49 inches; mottled yellowish brown (10YR 5/4 and 5/6) and light brownish gray (2.5Y 6/2) loam; very weak coarse prismatic structure; firm; few fine prominent strong brown (7.5YR 5/8) concretions of iron oxide and many fine dark soft accumulations of manganese oxide; few fine pebbles; medium and coarse sands; slightly acid; gradual smooth boundary.

2C—49 to 60 inches; mottled yellowish brown (10YR 5/4 and 5/6) and light brownish gray (2.5Y 6/2) loam; massive; firm; few fine pebbles; neutral.

The solum ranges from 40 to 60 inches in thickness, and the loess ranges from 20 to 40 inches in thickness. The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The BA and B horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. In some pedons thin layers of sandy loam, sandy clay loam, or loamy sand are at the loess-glacial till contact. The 2B, 2BC, and 2C horizons have hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 to 6. They are loam or clay loam.

Lamont Series

The Lamont series consists of well drained, moderately rapidly permeable soils on uplands and high stream benches. These soils formed in eolian sands. The native vegetation was deciduous trees. Slope ranges from 2 to 18 percent.

Typical pedon of Lamont fine sandy loam, 5 to 9 percent slopes, in a cultivated field; 120 feet east and 1,900 feet south of the northwest corner of sec. 29, T. 85 N., R. 4 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; common very fine fibrous roots; neutral; abrupt smooth boundary.

BE—9 to 17 inches; brown (10YR 5/3) fine sandy loam mixed with some dark yellowish brown (10YR 4/4) in the lower part, very pale brown (10YR 7/3) dry; weak medium and fine subangular blocky structure; very friable; few very fine fibrous roots; neutral; clear smooth boundary.

Bt1—17 to 27 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium and fine subangular blocky structure; very friable; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds and clay bridges between sand grains; some thin strong brown (7.5YR 5/6) and brown (7.5YR 4/4) soft accumulations of iron and manganese oxide; neutral; gradual smooth boundary.

Bt2—27 to 33 inches; brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) fine sandy loam; weak medium and fine subangular blocky structure; very friable; some distinct clay bridges between sand grains; some thin light yellowish brown (10YR 6/4) sand lenses; neutral; gradual smooth boundary.

Bt&E—33 to 52 inches; strong brown (7.5YR 5/6) fine sandy loam (Bt) and thin layer of brown (7.5YR 4/4) loamy fine sand (E); weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

2E&Bt—52 to 60 inches; yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) loamy sand (E); single grain; loose; thin lamellae of brown (7.5YR 4/4) loam and fine sandy loam (Bt); strongly acid.

The solum ranges from 30 to more than 60 inches in thickness. The A or Ap horizon has value of 3 or 4 and chroma of 1 or 2. It is sandy loam, fine sandy loam, or loam. Some pedons have a weakly expressed AE or E horizon, which has value of 3 to 5 and chroma of 2 or 3. The BE horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The Bt horizon has colors similar to those of the BE horizon. It is typically fine sandy loam, but in some pedons it is loam, sandy clay loam, or loamy fine sand in the lower part. The Bt&E and 2E&Bt horizons have hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. The E part is loamy sand, loamy fine sand, or sand, and the Bt part is fine sandy loam, sandy loam, or loam.

Lawler Series

The Lawler series consists of somewhat poorly drained soils on stream terraces. These soils formed in 32 to 40 inches of local alluvium and in the underlying coarse textured sediments. Permeability is moderate in the upper part of the profile and very rapid in the substratum. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Lawler silt loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 1,740 feet west and 660 feet south of the northeast corner of sec. 11, T. 83 N., R. 3 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

A—8 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; clear smooth boundary.

AB—15 to 21 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; few fine distinct brown (10YR 4/3) mottles; moderate medium and fine subangular blocky structure; friable; few fine fibrous roots; slightly acid; gradual smooth boundary.

Bw1—21 to 29 inches; dark grayish brown (10YR 4/2) loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium and fine subangular blocky structure; friable; few fine fibrous roots; medium acid; gradual smooth boundary.

Bw2—29 to 35 inches; dark grayish brown (10YR 4/2) loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium and fine subangular blocky structure; friable; few fine fibrous roots; medium acid; gradual smooth boundary.

2BC—35 to 38 inches; grayish brown (2.5Y 5/2) sandy loam; common fine prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) and few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very friable; few fine fibrous roots; medium acid; clear wavy boundary.

2C1—38 to 44 inches; mottled strong brown (7.5YR 5/6), yellowish brown (10YR 5/4), and grayish brown (2.5Y 5/2) loamy sand; massive; very friable; few fine dark soft accumulations of manganese oxide; few fine pebbles; medium acid; clear wavy boundary.

2C2—44 to 50 inches; mottled strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and grayish brown (2.5Y 5/2) sand; single grain; loose; few fine pebbles; medium acid; diffuse smooth boundary.

2C3—50 to 60 inches; yellowish brown (10YR 5/4) very gravelly sand; single grain; loose; about 40 percent gravel; medium acid.

The solum ranges from 24 to 40 inches in thickness and commonly is the same as the depth to sand and gravel. The A horizon is silt loam, loam, or clay loam. It has value of 2 or 3 and chroma of 1 or 2. The AB is as much as 6 inches thick. It has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. The Bw horizon is typically loam, but the range includes sandy clay loam. The 2BC horizon is in areas where the depth to sand and gravel is near the minimum for the series. It typically ranges from sandy loam to gravelly loamy sand. The 2C horizon has hue of 7.5YR, 10YR, and 2.5Y and value of 4 or 5. It is loamy sand, sand, gravelly loamy sand, gravelly sand, or very gravelly sand.

Lawson Series

The Lawson series consists of somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Lawson silt loam, 0 to 2 percent slopes, in a cultivated field; 400 feet north and 500 feet west of the southeast corner of sec. 8, T. 85 N., R. 1 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; some fine fibrous roots; neutral; abrupt smooth boundary.

A1—8 to 17 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; some fine fibrous roots; neutral; gradual smooth boundary.

A2—17 to 26 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

A3—26 to 32 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; few fine distinct brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

C1—32 to 38 inches; very dark gray (10YR 3/1) silty clay loam; common fine distinct brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

C2—38 to 48 inches; very dark grayish brown (10YR 3/2) silt loam; common fine distinct brown (7.5YR 4/4) and common medium distinct brown (10YR 4/3) mottles; weak fine subangular blocky structure; neutral; friable; gradual smooth boundary.

C3—48 to 54 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct brown (7.5YR 4/4), common medium distinct yellowish brown (10YR 5/6), and few prominent distinct grayish brown (2.5Y 5/2) mottles; massive; friable; neutral; gradual smooth boundary.

C4—54 to 60 inches; dark grayish brown (10YR 4/2) silt loam stratified with thin lenses of fine sand; many fine distinct brown (7.5YR 4/4) and common medium distinct grayish brown (2.5Y 5/2) mottles; massive; friable; neutral.

The solum ranges from 24 to 40 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 to 3. It is silt loam or silty clay loam.

Lindley Series

The Lindley series consists of well drained, moderately slowly permeable soils on uplands. These soils formed in glacial till. The native vegetation was deciduous trees. Slope ranges from 5 to 25 percent.

Typical pedon of Lindley loam, 5 to 9 percent slopes, moderately eroded, in a cultivated field; 115 feet east and 40 feet north of the southwest corner of sec. 24, T. 86 N., R. 2 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light yellowish brown (10YR 6/4) dry; streaks and pockets of dark yellowish brown (10YR 4/4); weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

Bt1—8 to 13 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; few distinct clay films on faces of peds; few faint light gray (10YR 7/2 dry) silt coatings on faces of peds; few fine fibrous roots; few fine pebbles; medium acid; gradual smooth boundary.

Bt2—13 to 19 inches; yellowish brown (10YR 5/4) clay loam; moderate medium and fine angular blocky structure; friable; few distinct clay films on faces of peds; few faint light gray (10YR 7/2 dry) silt coatings on faces of peds; few fine fibrous roots; few fine pebbles; medium acid; clear smooth boundary.

Bt3—19 to 29 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium and fine angular and subangular blocky; friable; few distinct clay films on faces of prisms; few faint light gray (10YR 7/2 dry) silt coatings on faces of prisms and peds; many fine dark soft accumulations of manganese oxide; few fine fibrous roots; few fine pebbles; strongly acid; clear smooth boundary.

Bt4—29 to 38 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct brown (7.5YR 5/4) and yellowish brown (10YR 5/8) mottles; moderate coarse prismatic structure parting to moderate medium angular and subangular blocky; friable; few faint clay films on faces of prisms; few faint light gray (10YR 7/2 dry) silt coatings on faces of prisms and peds; few fine pebbles; many fine dark soft accumulations of manganese oxide; few fine fibrous roots; strongly acid; gradual smooth boundary.

BC—38 to 49 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct strong brown (7.5YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; moderate coarse prismatic structure parting to moderate medium and fine angular and subangular blocky; firm; many fine dark soft accumulations of manganese oxide; few fine fibrous roots; few fine pebbles; strongly acid; gradual smooth boundary.

C—49 to 60 inches; mottled grayish brown (10YR 5/2), light brownish gray (10YR 6/2), yellowish brown (10YR 5/4), and strong brown (7.5YR 5/8) loam; appears massive but has some vertical cleavage; firm; few fine pebbles; strongly acid.

The solum ranges from 30 to 50 inches in thickness. The Ap horizon typically is loam, but in some pedons it is silt loam or clay loam. It has value of 4 or 5 and chroma of 2 to 5. In uncultivated areas the A horizon has value of 3 or 4 and chroma of 1 or 2. Some pedons have an E horizon, which has value of 4 to 6 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is commonly clay loam, but the range includes loam.

Marshan Series

The Marshan series consists of poorly drained soils in drainageways and on stream terraces. These soils formed in 32 to 40 inches of loamy sediments overlying sandy and gravelly sediments. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field; 900 feet south and 1,600 feet east of the center of sec. 19, T. 86 N., R. 4 W.

Ap—0 to 9 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

A—9 to 15 inches; black (N 2/0) loam, black (10YR 2/1) dry; weak fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

AB—15 to 21 inches; very dark grayish brown (2.5Y 3/2) clay loam, olive gray (5Y 4/2) dry; common fine distinct light olive brown (2.5Y 5/4) mottles; weak fine subangular blocky structure; friable; few fine fibrous roots; gradual smooth boundary.

Bg1—21 to 29 inches; grayish brown (2.5Y 5/2) clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; few fine pebbles; neutral; gradual smooth boundary.

Bg2—29 to 38 inches; mottled grayish brown (2.5Y 5/2), light yellowish brown (2.5Y 6/4), and brownish yellow (10YR 6/8) sandy loam; moderate medium and fine subangular blocky structure; friable; few fine pebbles; neutral; abrupt wavy boundary.

2Cg1—38 to 43 inches; light brownish gray (2.5Y 6/2) sand; few fine distinct olive yellow (2.5Y 6/6) mottles; single grain; loose; few fine pebbles; neutral; clear smooth boundary.

2Cg2—43 to 60 inches; light brownish gray (2.5Y 6/2) sand; single grain; loose; about 10 percent gravel; neutral.

The solum ranges from 24 to 40 inches in thickness and corresponds to the depth to sand and gravel. The mollic epipedon ranges from 12 to 24 inches in thickness.

The A horizon has hue of 10YR to 5Y, value of 2 or 3, and chroma of 1 in the upper part and chroma of 1 or 2 in the lower part, or it is neutral in hue and has value of 2 or 3. It is typically loam, but the range includes clay loam, silty clay loam, and silt loam. The Bg horizon has hue of 2.5Y, 5Y, or 10YR, value of 4 or 5, and chroma of 1 or 2. The upper part of this horizon is clay loam, loam, or silty clay loam. The lower part is typically sandy loam, but the range includes loam and clay loam. The 2C horizon is sand, coarse sand, or gravelly coarse sand. The content of gravel in this horizon commonly is 5 to 50 percent.

Maxfield Series

The Maxfield series consists of poorly drained, moderately permeable soils in upland drainageways. These soils formed in loess and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Maxfield silty clay loam, 0 to 2 percent slopes, in a cultivated field; 800 feet west and 300 feet north of the southeast corner of sec. 31, T. 84 N., R. 4 W.

Ap—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few very fine fibrous roots; neutral; abrupt smooth boundary.

A1—9 to 14 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

A2—14 to 19 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; clear smooth boundary.

BA—19 to 23 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Bg—23 to 35 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/8) and common fine distinct light yellowish brown (2.5Y 6/4) mottles; weak fine subangular blocky structure; friable; a stone line at a depth of about 35 inches; few fine pebbles; neutral; gradual wavy boundary.

2BC—35 to 45 inches; yellowish brown (10YR 5/8) loam; few fine prominent brown (7.5YR 5/4) and many fine prominent light brownish gray (2.5Y 6/2) mottles; moderate medium prismatic structure; firm; some grayish brown (2.5Y 5/2) coatings on faces of prisms; thin lenses of fine sandy loam between depths of 35 and 37 inches; few fine dark soft accumulations of manganese oxide; few fine pebbles; neutral; gradual smooth boundary.

2C1—45 to 56 inches; mottled light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/8), and strong brown (7.5YR 5/8) loam; appears massive but has some vertical cleavage; firm; few fine dark soft accumulations of manganese oxide; few fine pebbles; mildly alkaline; slightly effervescent; gradual smooth boundary.

2C2—56 to 60 inches; light yellowish brown (2.5Y 6/4) loam; common medium distinct light gray (5Y 7/2) and light olive brown (2.5Y 5/6) and few medium distinct grayish brown (2.5Y 5/2) mottles; massive; firm; few fine dark soft accumulations of manganese oxide; few fine pebbles; mildly alkaline; slightly effervescent.

The solum ranges from 36 to 60 inches in thickness. The depth to carbonates ranges from 40 to 60 inches.

The A horizon is black (N 2/0 or 10YR 2/1) or very dark gray (10YR 3/1). The Bg horizon has hue of 2.5Y or 5Y and value of 4 or 5. It is silty clay loam or silt loam. The layer that has the highest content of clay is in the lower part of the A horizon or the upper part of the B horizon. The 2BC horizon has hue of 10YR or 7.5YR and chroma of 4 to 8. The 2C horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 5 or 6, and chroma of 2 to 8.

Muscatine Series

The Muscatine series consists of somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess. The native vegetation was prairie grasses. Slope ranges from 1 to 4 percent.

Typical pedon of Muscatine silt loam, 1 to 4 percent slopes, in a cultivated field; 900 feet east and 200 feet south of the northwest corner of sec. 24, T. 85 N., R. 3 W.

Ap—0 to 6 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

A1—6 to 12 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; clear smooth boundary.

A2—12 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

BA—18 to 22 inches; dark brown (10YR 3/3) silty clay loam; moderate fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bgt1—22 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint brown (7.5YR 4/4) mottles; moderate medium and fine subangular blocky structure; friable; few faint clay films on faces of peds; medium acid; clear smooth boundary.

Bgt2—26 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) and many fine faint light brownish gray (2.5Y 6/2) mottles; moderate medium and fine subangular blocky structure; friable; few distinct clay films on faces of peds; medium acid; gradual smooth boundary.

Bgt3—34 to 42 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; few faint clay films on faces of peds; few fine dark soft accumulations of manganese oxide; medium acid; gradual smooth boundary.

BCg—42 to 50 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6 and 5/8) mottles; weak medium and fine subangular blocky structure; friable; common fine dark soft accumulations of manganese oxide; slightly acid; gradual smooth boundary.

Cg—50 to 60 inches; mottled light brownish gray (2.5Y 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/8) silt loam; massive; friable; common fine dark soft accumulations of manganese oxide; neutral.

The solum ranges from 40 to 60 inches in thickness. The mollic epipedon is 20 to 24 inches thick.

The A horizon has chroma of 1 or 2. It is silt loam or silty clay loam. The Bg horizon has hue of 10YR or 2.5Y in the upper part and value of 5 or 6 and chroma of 2 to 4 in the lower part. The BC and C horizons have hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 2 to 4.

Nordness Series

The Nordness series consists of well drained, moderately permeable soils on uplands. These soils formed in 8 to 20 inches of loamy or silty material and in a thin layer of clayey residuum over limestone bedrock. The native vegetation was deciduous trees. Slope ranges from 5 to 40 percent.

Typical pedon of Nordness loam, 5 to 14 percent slopes, in a wooded area used as pasture; 1,020 feet north and 900 feet east of the southwest corner of sec. 11, T. 86 N., R. 1 W.

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

E—2 to 5 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; moderate medium and thin platy structure parting to weak fine granular; friable; neutral; clear smooth boundary.

BE—5 to 8 inches; mixed brown (10YR 4/3) and very dark grayish brown (10YR 3/2) loam; moderate medium and fine subangular blocky structure; friable; neutral; clear smooth boundary.

2Bt—8 to 14 inches; brown (7.5YR 4/4) and reddish brown (5YR 4/4) silty clay loam; moderate medium and fine angular and subangular blocky structure; friable; few faint clay films on faces of peds; neutral; abrupt wavy boundary.

2R1—14 to 18 inches; level-bedded limestone bedrock; slabs of rock 2 to 5 inches thick; thin accumulations of yellowish red (5YR 4/6) silty clay between slabs and in vertical weathering joints; fine textured material makes up about 5 percent of volume.

2R2—18 inches; level-bedded, fractured limestone bedrock.

The thickness of the solum and the depth to limestone range from 8 to 20 inches. The A horizon has value of 3 or 4 and chroma of 1 or 2. The A and E horizons are silt loam or loam. The 2B horizon has hue of 10YR, 7.5YR, or 5YR. It is silty clay loam, loam, or clay loam. The content of clay in this horizon ranges from 22 to 35 percent.

Olin Series

The Olin series consists of well drained, moderately permeable soils on uplands. These soils formed in sandy loam eolian material and in the underlying loamy glacial till. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Olin fine sandy loam, 2 to 5 percent slopes, in a cultivated field; 2,440 feet south and 340 feet east of the northwest corner of sec. 21, T. 86 N., R. 4 W.

Ap—0 to 8 inches; black (10YR 2/1) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—8 to 14 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.

A2—14 to 23 inches; dark brown (10YR 3/3) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; very dark grayish brown (10YR 3/2) coatings on faces of peds; neutral; clear smooth boundary.

Bw1—23 to 26 inches; brown (10YR 4/3) fine sandy loam; very weak fine subangular blocky structure; very friable; dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) coatings on faces of peds and root channels; neutral; clear smooth boundary.

2Bw2—26 to 31 inches; yellowish brown (10YR 5/4) loam; moderate fine angular and subangular blocky structure; friable; few fine pebbles; slightly acid; gradual smooth boundary.

2Bw3—31 to 36 inches; yellowish brown (10YR 5/4) loam; common medium distinct strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure parting to moderate fine angular blocky; firm; few fine pebbles; slightly acid; gradual smooth boundary.

2Bw4—36 to 46 inches; yellowish brown (10YR 5/6) loam; common fine distinct strong brown (7.5YR 5/8) and pale brown (10YR 6/3) mottles; moderate coarse prismatic structure; firm; few fine pebbles; neutral; gradual smooth boundary.

2C—46 to 60 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/8), and grayish brown (10YR 5/2) loam; massive; firm; few fine dark soft accumulations of manganese oxide; few fine pebbles; neutral.

The solum ranges from 40 to 60 inches in thickness. The depth to glacial till ranges from 24 to 36 inches, and the depth to carbonates ranges from 50 to 80 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is fine sandy loam or sandy loam. The Bw horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons have a BA horizon. The Bw horizon is commonly fine sandy loam or sandy loam, but in some pedons it has layers of loamy sand. The 2Bw horizon has value of 4 or 5 and chroma of 3 to 6. It is commonly loam, but the range includes clay loam and sandy clay loam. The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is loam or clay loam.

Orion Series

The Orion series consists of somewhat poorly drained, moderately permeable soils on narrow bottom land and alluvial fans. These soils formed in light colored, recently deposited silty alluvium overlying a dark, buried silty soil. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 0 to 2 percent.

The Orion soils in this county are taxadjuncts because the content of clay is too high for the coarse-silty particle-size class, which is definitive for the series.

Typical pedon of Orion silt loam, 0 to 2 percent slopes, in a cultivated field; 800 feet west and 620 feet south of the northeast corner of sec. 11, T. 86 N., R. 2 W.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak thin platy structure parting to weak fine granular; friable; few fine fibrous roots; slightly acid; abrupt smooth boundary.

C—11 to 28 inches; stratified dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), and grayish brown (10YR 5/2) silt loam; thin lenses of very fine sand; common fine prominent yellowish red (5YR 5/8) mottles in the lower part; massive with weak bedding planes that result largely from stratification during deposition; friable; few fine fibrous roots; neutral; abrupt wavy boundary.

Ab1—28 to 34 inches; black (10YR 2/1) silt loam mixed with some dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2); many fine prominent yellowish red (5YR 5/8) and few fine prominent red (2.5YR 4/8) mottles; weak fine granular structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Ab2—34 to 44 inches; black (10YR 2/1) silt loam; few fine prominent yellowish red (5YR 5/8) and brown (7.5YR 4/4) mottles; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; slightly acid; gradual smooth boundary.

C—44 to 60 inches; mixed very dark grayish brown (10YR 3/2) and black (10YR 2/1) silt loam; thin strata of grayish brown (10YR 5/2); common fine prominent yellowish red (5YR 5/8) mottles; appears massive but has some vertical cleavage; friable; few fine fibrous roots; medium acid.

Depth to the Ab horizon ranges from 20 to 40 inches. The color, arrangement, and thickness of all horizons vary because the source of the sediments and the pattern of deposition differ from area to area. The Ap or A horizon has value of 3 to 5 and chroma of 1 to 3. The C horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. The Ab horizon has hue of 10YR or

2.5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It typically is more than 10 inches thick.

Orwood Series

The Orwood series consists of well drained, moderately permeable soils on uplands. These soils formed in loamy and silty eolian material. The native vegetation was mixed deciduous trees and prairie grasses. Slope ranges from 5 to 25 percent.

The Orwood soils in this county are taxadjuncts to the series because they do not have the increase in content of clay needed for an argillic horizon.

Typical pedon of Orwood silt loam, 5 to 9 percent slopes, in a cultivated field; 240 feet south and 1,920 feet east of the northwest corner of sec. 3, T. 84 N., R. 2 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; few fine fibrous roots; neutral; abrupt smooth boundary.

BE—7 to 12 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) and yellowish brown (10YR 5/4) dry; dark brown (10YR 3/3) streaks and pockets in the upper part; weak fine subangular blocky structure; friable; few fine fibrous roots; slightly acid; clear smooth boundary.

Bt1—12 to 21 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds and root channels; few distinct light gray (10YR 7/2 dry) silt coatings; few fine fibrous roots; slightly acid; gradual smooth boundary.

Bt2—21 to 31 inches; dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds and root channels; few distinct light gray (10YR 7/2 dry) silt and fine sand coatings; few fine fibrous roots; slightly acid; clear smooth boundary.

Bt3—31 to 35 inches; yellowish brown (10YR 5/6) loam; moderate fine subangular blocky structure; friable; few faint clay films and fine sand coatings on faces of peds; slightly acid; clear smooth boundary.

Bt4—35 to 41 inches; mixed yellowish brown (10YR 5/4 and 10YR 5/6) silt loam; weak medium and fine subangular blocky structure; friable; few faint clay films and fine sand coatings on faces of peds; slightly acid; gradual smooth boundary.

BC—41 to 54 inches; yellowish brown (10YR 5/4) silt loam; weak coarse prismatic structure parting to weak medium subangular blocky; friable; few lenses of yellowish brown (10YR 5/6 and 5/8) fine sand; medium acid; gradual smooth boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) loam; common fine distinct light brownish gray (2.5Y 6/2) and brown (7.5YR 4/4) mottles; massive; friable; slightly acid.

The solum ranges from 40 to 70 inches in thickness. The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an E horizon. The A and E horizons are silt loam or loam. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is silt loam or loam. The BC and C horizons have value of 4 or 5 and chroma of 4 to 6. They are loam or silt loam.

Ossian Series

The Ossian series consists of poorly drained, moderately permeable soils on bottom land and low stream terraces. These soils formed in silty alluvium. The native vegetation was water-tolerant grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Ossian silt loam, 0 to 2 percent slopes, in a cultivated field; 100 feet east and 310 feet north of the southwest corner of sec. 12, T. 85 N., R. 4 W.

Ap—0 to 6 inches; black (10YR 2/1) silt loam (24 percent clay), very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure parting to weak fine granular; friable; many fine fibrous roots; neutral; abrupt smooth boundary.

A—6 to 14 inches; black (10YR 2/1) silt loam (25 percent clay), very dark gray (10YR 3/1) dry; moderate medium and fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

BA—14 to 17 inches; very dark gray (5Y 3/1) and very dark grayish brown (2.5Y 3/2) silt loam (23 percent clay); moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Bg1—17 to 26 inches; olive gray (5Y 4/2) silt loam (22 percent clay); common fine distinct olive (5Y 4/3 and 5/3) and few fine prominent light olive brown (2.5Y 5/6) mottles; weak fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Bg2—26 to 36 inches; light olive gray (5Y 6/2) silt loam (24 percent clay); few fine prominent light olive brown (2.5Y 5/6) mottles; weak medium and fine subangular blocky structure; friable; few fine fibrous roots; neutral; diffuse smooth boundary.

Bg3—36 to 47 inches; light olive gray (5Y 6/2) silt loam (22 percent clay); common fine prominent light olive brown (2.5Y 5/6) mottles; weak coarse prismatic structure parting to weak medium and fine subangular blocky; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Cg1—47 to 57 inches; light olive gray (5Y 6/2) silty clay loam (30 percent clay); common medium and fine prominent light olive brown (2.5Y 5/6) mottles; appears massive but has some vertical cleavage; friable; few fine dark accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Cg2—57 to 60 inches; mottled dark yellowish brown (10YR 4/6), yellowish brown (10YR 5/8), and light olive gray (5Y 6/2) silty clay loam (27 percent clay); massive; friable; neutral.

The solum ranges from 40 to 48 inches in thickness. The mollic epipedon ranges from 14 to 24 inches in thickness.

The Ap and A horizons have hue of 10YR or 5Y or are neutral in hue. They have chroma of 0 or 1. They are typically silt loam or silty clay loam. The Bg horizon has value of 4 to 6 and chroma of 1 or 2. It is silt loam or silty clay loam. The Cg horizon has colors similar to those of the B horizon. It is silty clay loam or silt loam.

Ostrander Series

The Ostrander series consists of well drained, moderately permeable soils on uplands. These soils formed in loamy erosional sediments and in the underlying glacial till. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Ostrander loam, 2 to 5 percent slopes, in a cultivated field; 200 feet north and 360 feet east of the southwest corner of sec. 29, T. 86 N., R. 3 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; medium acid; abrupt smooth boundary.

A—7 to 14 inches; very dark gray (10YR 3/1) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; few fine fibrous roots; slightly acid; gradual smooth boundary.

AB—14 to 18 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; few fine fibrous roots; medium acid; clear smooth boundary.

Bw1—18 to 27 inches; dark brown (10YR 3/3) loam mixed with brown (10YR 4/3) in the lower part; moderate fine subangular blocky structure; friable; a stone line at a depth of about 27 inches; few fine fibrous roots; medium acid; clear wavy boundary.

2Bw2—27 to 33 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate medium and fine subangular blocky structure; friable; few fine pebbles; medium acid; gradual smooth boundary.

2Bw3—33 to 40 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent light gray (2.5Y 7/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium and fine subangular blocky; friable; few fine pebbles; slightly acid; clear smooth boundary.

2BC—40 to 46 inches; yellowish brown (10YR 5/6) sandy clay loam; many medium prominent light gray (2.5Y 7/2) and strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; firm; few fine pebbles; slightly acid; gradual smooth boundary.

3C—46 to 60 inches; yellowish brown (10YR 5/4) loam; many medium prominent light brownish gray (2.5Y 6/2) and distinct strong brown (7.5YR 5/6) mottles; massive; firm; few very fine dark soft accumulations of manganese oxide; few fine pebbles; neutral.

The solum ranges from 44 to 76 inches in thickness. The loamy sediments range from 12 to 28 inches in thickness. The depth to glacial till ranges from 30 to 56 inches. The mollic epipedon ranges from 10 to 18 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It is commonly loam, but the range includes silt loam, clay loam, and silty clay loam. The Bw horizon has value and chroma of 3 or 4. The 2Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 8. It is loam, sandy loam, or sandy clay loam. The 3C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 to 8.

Palms Series

The Palms series consists of very poorly drained soils in drainageways, on outwash terraces, and in depressions on bottom land. These soils formed in well decomposed organic material overlying thick loamy mineral material. Permeability is moderately slow to moderately rapid in the organic material and moderate or moderately slow in the loamy material. The native vegetation was water-tolerant grasses, reeds, sedges, and deciduous trees. Slope ranges from 0 to 3 percent.

Typical pedon of Palms muck, 0 to 3 percent slopes; 800 feet west and 120 feet south of the northeast corner of sec. 5, T. 86 N., R. 3 W.

Oa1—0 to 13 inches; sapric material, black (10YR 2/1) broken face and rubbed, very dark brown (10YR 2/2) dry; about 30 percent fiber, 8 percent rubbed; moderate medium granular structure; friable; many fine undecomposed roots; herbaceous fibers; about 7 percent mineral material; slightly acid; gradual smooth boundary.

Oa2—13 to 22 inches; sapric material, black (N 2/0) broken face and rubbed, very dark gray (10YR 3/1) dry; about 18 percent fiber, 1 percent rubbed; weak medium and fine granular structure; slightly sticky; many medium and fine undecomposed roots; herbaceous fibers; about 48 percent mineral material; medium acid; clear smooth boundary.

Oa3—22 to 31 inches; sapric material, black (10YR 2/1) broken face and rubbed, very dark brown (10YR 2/2) dry; about 42 percent fiber, 16 percent rubbed; massive parting to weak coarse subangular blocky structure; slightly sticky; many medium and fine undecomposed roots; herbaceous fibers; about 70 percent mineral material; neutral; clear smooth boundary.

Cg—31 to 60 inches; dark gray (5Y 4/1) silt loam; thin layer of very dark grayish brown (2.5Y 3/2) in the lower part; massive; friable; about 16 percent fiber, 1 percent rubbed; neutral.

The sapric material commonly ranges from 18 to 40 inches in thickness, but in some pedons it is as much as 50 inches thick. It is neutral in hue or has hue of 10YR, 7.5YR, or 5YR. It has value of 2 to 4 and chroma of 0 to 3. The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 7, and chroma of 1 or 2. It generally is silt loam, silty clay loam, or loam but has sandy strata in some pedons.

Perks Series

The Perks series consists of excessively drained, moderately rapidly permeable soils on flood plains. These soils formed in sandy alluvium. The native vegetation was deciduous trees. Slope ranges from 0 to 2 percent.

Typical pedon of Perks sandy loam, 0 to 2 percent slopes, in a previously cultivated field; 200 feet west and 1,600 feet south of the northeast corner of sec. 2, T. 83 N., R. 3 W.

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

C1—8 to 30 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 5 percent gravel; few fine pebbles; slightly acid; gradual smooth boundary.

C2—30 to 36 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 5 percent gravel; slightly acid; gradual smooth boundary.

C3—36 to 45 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 5 percent gravel; few fine pebbles; slightly acid; gradual smooth boundary.

C4—45 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 15 percent gravel; slightly acid.

The solum is commonly less than 10 inches thick. It corresponds to the thickness of the A or Ap horizon. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. In uncultivated areas it has value of 2 or 3 and chroma of 1 or 2. The C horizon typically has value of 4 or 5 and chroma of 4 to 6.

Raddle Series

The Raddle series consists of well drained, moderately permeable soils on stream terraces. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Raddle silt loam, 0 to 2 percent slopes, in a cultivated field; 2,300 feet west and 100 feet north of the southeast corner of sec. 16, T. 86 N., R. 3 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

A—10 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

BA—18 to 24 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw1—24 to 30 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw2—30 to 42 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw3—42 to 51 inches; yellowish brown (10YR 5/4) silt loam; common fine faint brown (10YR 5/3) and distinct light brownish gray (2.5Y 6/2) mottles; weak fine subangular blocky structure; friable; many fine reddish brown (5YR 5/4) and yellowish red (5YR 5/6) soft accumulations of iron and manganese oxide; thin strata of very fine sand less than 1 inch thick; slightly acid; gradual smooth boundary.

C—51 to 60 inches; mottled brown (7.5YR 5/2) and light brownish gray (2.5Y 6/2) silt loam; massive; friable; common reddish brown (5YR 4/4) soft accumulations of iron and manganese oxide; thin strata of very fine sand less than 1 inch thick; slightly acid.

The solum commonly is 50 to 65 inches thick but ranges from 40 to more than 80 inches in thickness. The mollic epipedon ranges from 10 to 24 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. The content of clay in the B horizon typically ranges from 18 to 24 percent. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4.

Ripon Series

The Ripon series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying glacial till over limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 2 to 7 percent.

Typical pedon of Ripon silt loam, 2 to 7 percent slopes, in a cultivated field; 2,000 feet east and 1,000 feet south of the northwest corner of sec. 11, T. 86 N., R. 3 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

A—10 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

Bt1—17 to 24 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few distinct clay films on faces of peds; dark brown (10YR 3/3) coatings on faces of peds; slightly acid; clear smooth boundary.

2Bt2—24 to 30 inches; brown (7.5YR 4/4) clay loam; moderate medium and fine subangular blocky structure; firm; many distinct dark reddish brown (5YR 3/2) clay films and few very dark brown (10YR 2/2) coatings on faces of peds; neutral; clear wavy boundary.

R—30 inches; hard limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The loess ranges from 20 to 36 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The content of clay in this horizon ranges from 25 to 35 percent. The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is clay loam, sandy clay loam, or loam.

Rockton Series

The Rockton series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in 20 to 40 inches of loamy material and in a thin layer of clayey residuum over limestone bedrock. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Rockton loam, 2 to 5 percent slopes, in a cultivated field; 2,200 feet north and 320 feet east of the southwest corner of sec. 20, T. 85 N., R. 4 W.

Ap—0 to 10 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; few fine fibrous roots; neutral; abrupt smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

Bt1—15 to 22 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; few fine fibrous roots; medium acid; gradual smooth boundary.

Bt2—22 to 28 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; few distinct clay films on faces of peds; very few fine fibrous roots; medium acid; clear smooth boundary.

2Bt3—28 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium and fine subangular blocky structure; friable; few distinct clay films on faces of peds and in root channels; common soft white (10YR 8/2) limestone fragments in the lower part; neutral; abrupt wavy boundary.

2R—32 inches; hard, level-bedded limestone bedrock that is weathered in the upper few inches; small amounts of dark, clayey material between fragments in the upper few inches.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The mollic epipedon ranges from 10 to 18 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam or silt loam. The Bt horizon has hue of 10YR in the upper part and 7.5YR or 5YR in the lower part. It has value of 4 or 5 and chroma of 3 or 4. It is loam, sandy clay loam, or clay loam. The content of clay in this horizon ranges from 25 to 35 percent. The 2Bt horizon is commonly 1 to 6 inches thick, but in some pedons the only evidence of the 2Bt horizon is thin films around limestone fragments. It is clay loam, clay, or silty clay.

Sattre Series

The Sattre series consists of well drained soils on stream terraces. These soils formed in loamy alluvial sediments overlying sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was deciduous trees and prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Sattre loam, 0 to 2 percent slopes, in a cultivated field; 1,900 feet east and 350 feet north of the southwest corner of sec. 27, T. 86 N., R. 3 W.

Ap—0 to 5 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; neutral; abrupt smooth boundary.

E—5 to 10 inches; dark grayish brown (10YR 4/2) loam mixed with brown (10YR 4/3) and very dark brown (10YR 2/2), brown (10YR 5/3) dry; very weak medium platy structure parting to weak very fine subangular blocky; friable; neutral; clear smooth boundary.

Bt1—10 to 16 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—16 to 26 inches; brown (7.5YR 4/4) loam; moderate medium and fine subangular blocky structure; friable; few distinct clay films on faces of peds; neutral; gradual smooth boundary.

Bt3—26 to 35 inches; brown (7.5YR 4/4) loam; moderate coarse prismatic structure parting to moderate medium and fine angular and subangular blocky; friable; few faint clay films on faces of prisms and peds; neutral; abrupt wavy boundary.

BC—35 to 38 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; very friable; neutral; clear smooth boundary.

2E&Bt—38 to 60 inches; yellowish brown (10YR 5/6) sand; single grain; loose; thin lamellae of dark yellowish brown (10YR 4/4) sandy loam; slightly acid.

The solum ranges from 24 to 40 inches in thickness. The depth to sand ranges from 30 to 40 inches. It does not coincide with the thickness of the solum in all pedons.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is commonly loam, but in some pedons it is silt loam that is high in content of sand. Some pedons have a BE horizon. The E or BE horizon has chroma of 2 or 3 and, in some pedons, has mixed darker colors. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. It is loam, clay loam, or sandy clay loam that grades to sandy loam in the lower part. The 2E&Bt horizon is loamy sand or sand. The content of gravel in some strata is as much as 20 to 50 percent.

Saude Series

The Saude series consists of well drained soils on stream terraces. These soils formed in 20 to 30 inches of loamy material overlying coarse sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Saude loam, 0 to 2 percent slopes, in a cultivated field; 1,300 feet west and 135 feet north of the southeast corner of sec. 17, T. 86 N., R. 4 W.

Ap—0 to 8 inches; black (10YR 2/1) loam (18 percent clay), grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

A—8 to 14 inches; very dark brown (10YR 2/2) loam (20 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw1—14 to 19 inches; dark brown (10YR 3/3) loam (17 percent clay) mixed with some brown (10YR 4/3) in the lower part; moderate fine angular and subangular blocky structure; friable; strongly acid; gradual smooth boundary.

Bw2—19 to 27 inches; dark yellowish brown (10YR 4/4) loam (16 percent clay); moderate fine subangular blocky structure; friable; few brown (10YR 4/3) coatings on faces of peds in the upper part and very dark grayish brown (10YR 3/2) coatings in root channels; few fine strong brown (7.5YR 5/6) soft accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

2BC—27 to 30 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand (14 percent clay); weak fine subangular blocky structure; very friable; about 25 percent gravel; strongly acid; clear smooth boundary.

2C—30 to 60 inches; yellowish brown (10YR 5/6) gravelly coarse sand (14 percent clay); single grain; about 20 percent gravel; loose; medium acid.

The solum ranges from 24 to 44 inches in thickness. The depth to sand and gravel is about 24 to 30 inches.

The A and Ap horizons have chroma of 1 or 2. The Bw horizon has value of 3 to 5 and chroma of 3 to 6. It is loam. The content of clay in this horizon ranges from 12 to 18 percent. The 2BC and 2C horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 2C horizon is gravelly sand, gravelly loamy sand, or sand. The content of gravel typically ranges from 5 to 30 percent, but it is as much as 50 percent in some thin strata.

Sawmill Series

The Sawmill series consists of poorly drained, moderately permeable soils on flood plains. These soils formed in silty alluvial sediments. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Sawmill silty clay loam, 0 to 2 percent slopes, in a cultivated field; 150 feet east and 50 feet south of the northwest corner of sec. 13, T. 85 N., R. 4 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam (33 percent clay), dark gray (10YR 4/1) dry; weak fine angular and subangular blocky structure parting to weak fine granular; friable; many fine fibrous roots; mildly alkaline; abrupt smooth boundary.

A1—8 to 15 inches; black (10YR 2/1) silty clay loam (33 percent clay), very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; many fine fibrous roots; neutral; gradual smooth boundary.

A2—15 to 22 inches; black (10YR 2/1) silty clay loam (32 percent clay), very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

BA—22 to 32 inches; very dark gray (10YR 3/1) silty clay loam (33 percent clay), dark gray (10YR 4/1) dry; moderate fine prismatic structure parting to moderate and fine angular and subangular blocky; friable; very few fine strong brown (7.5YR 5/8) soft accumulations of iron oxide; few fine fibrous roots; neutral; gradual smooth boundary.

Bg1—32 to 37 inches; dark gray (10YR 4/1) silty clay loam (31 percent clay); common fine prominent light brownish gray (2.5Y 6/2) mottles; moderate fine prismatic structure parting to moderate medium and fine angular and subangular blocky; friable; few fine strong brown (7.5YR 5/8) soft accumulations of iron oxide; few fine fibrous roots; neutral; clear smooth boundary.

Bg2—37 to 43 inches; olive gray (5Y 5/2) silty clay loam (32 percent clay); many fine prominent yellowish red (5YR 5/8) mottles; moderate medium and fine prismatic structure parting to weak fine angular and subangular blocky; friable; few fine strong brown (7.5YR 5/8) soft accumulations of iron oxide; few fine fibrous roots; neutral; clear smooth boundary.

BC—43 to 50 inches; light olive gray (5Y 6/2) silt loam (26 percent clay); common fine prominent yellowish red (5YR 5/8) mottles; moderate medium and fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

C—50 to 60 inches; mottled olive gray (5Y 5/2), yellowish red (5YR 5/8), and strong brown (7.5YR 5/6) silt loam (16 percent clay); massive; friable; neutral.

The solum ranges from 36 to 60 inches in thickness. The mollic epipedon ranges from 24 to 36 inches in thickness.

The A horizon commonly has hue of 10YR, 2.5Y, or 5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 2 or less. The Bg horizon is silty clay loam or clay loam. The C horizon is silt loam, silty clay loam, or clay loam. In some pedons it has strata of loam, sandy loam, or silty clay.

Shandep Series

The Shandep series consists of very poorly drained soils in depressions on stream terraces and in outwash areas. These soils formed in loamy alluvial sediments overlying sand and gravel. Permeability is moderate in the upper part of the profile and rapid in the sand and gravel. The native vegetation was water-tolerant grasses. Slope is 0 to 1 percent.

Typical pedon of Shandep loam, 0 to 1 percent slopes, in a cultivated field; 500 feet east and 1,370 feet south of the center of sec. 28, T. 84 N., R. 3 W.

Ap—0 to 7 inches; black (5Y 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; few medium fibrous roots; neutral; abrupt smooth boundary.

A1—7 to 17 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; few medium fibrous roots; few fine pebbles; slightly acid; gradual smooth boundary.

A2—17 to 30 inches; black (5Y 2/1) clay loam, dark gray (10YR 4/1) dry; moderate medium and fine granular structure; friable; few fine fibrous roots; few fine pebbles; slightly acid; clear smooth boundary.

Bg1—30 to 36 inches; dark gray (5Y 4/1) clay loam; weak medium and fine subangular blocky structure; friable; few fine pebbles; slightly acid; gradual smooth boundary.

Bg2—36 to 48 inches; gray (5Y 5/1) clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; few fine pebbles; slightly acid; clear smooth boundary.

BCg—48 to 57 inches; very dark gray (5Y 3/1) loam, weak medium and fine subangular blocky structure; friable; few fine pebbles; slightly acid; abrupt wavy boundary.

2Cg—57 to 60 inches; dark gray (5Y 4/1) loamy sand; single grain; loose; many medium and fine pebbles; neutral.

The solum ranges from 40 to 60 inches in thickness. The mollic epipedon is 26 to 36 inches thick.

The A horizon is neutral in hue or has hue of 5Y. It has value of 2 or 3 and chroma of 1 or less. It is loam, clay loam, or silty clay loam. The Bg horizon has hue of 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 or 1. The BC horizon is loam, gravelly sandy loam, or sandy loam. The 2Cg horizon is typically loamy sand or gravelly loamy sand, but the range includes coarse sand, gravelly coarse sand, and gravelly loamy coarse sand.

Sparta Series

The Sparta series consists of excessively drained, rapidly permeable soils on uplands and stream terraces. These soils formed in eolian sand and sandy alluvium that has been reworked by wind. The native vegetation was prairie grasses. Slope ranges from 1 to 9 percent.

Typical pedon of Sparta loamy fine sand, 1 to 5 percent slopes, in a cultivated field; 1,400 feet east and 200 feet south of the center of sec. 3, T. 86 N., R. 3 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy fine sand (8 percent clay), dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

A—8 to 12 inches; very dark grayish brown (10YR 3/2) loamy fine sand (8 percent clay), grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; neutral; clear smooth boundary.

AB—12 to 17 inches; dark brown (10YR 3/3) loamy fine sand (9 percent clay); weak fine subangular blocky structure parting to weak fine granular; very friable; slightly acid; clear wavy boundary.

Bw—17 to 24 inches; brown (10YR 4/3) loamy fine sand (9 percent clay); weak coarse subangular blocky structure; very friable; neutral; gradual wavy boundary.

BC—24 to 30 inches; dark yellowish brown (10YR 4/4) fine sand (7 percent clay); weak coarse subangular blocky structure; very friable; neutral; gradual wavy boundary.

E/Bt—30 to 60 inches; yellowish brown (10YR 5/4) fine sand (E) (5 percent clay); single grain; loose; lamellae of strong brown (7.5YR 5/6) loamy fine sand (Bt) between depths of 43 and 45 inches; medium acid.

The solum ranges from 24 to 45 inches in thickness. The A horizon is 10 to 24 inches thick. It has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand, fine sand, and sand. The AB horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is loamy fine sand, loamy sand, fine sand, or sand. The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 6. It is loamy fine sand, loamy sand, fine sand, or sand. The E/Bt horizon has hue of

10YR and 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is fine sand or sand that has one or more lamellae ¼ inch to 2 inches thick.

Spillville Series

The Spillville series consists of moderately well drained or somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in loamy alluvial sediments. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Spillville loam, 0 to 2 percent slopes, in a cultivated field; 1,000 feet north and 150 feet west of the center of sec. 34, T. 84 N., R. 3 W.

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

A1—8 to 22 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak medium and fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; slightly acid; gradual smooth boundary.

A2—22 to 34 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

A3—34 to 44 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; few distinct light brownish gray (10YR 6/2 dry) silt and sand coatings on faces of peds; few fine fibrous roots; neutral; gradual smooth boundary.

A4—44 to 52 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few distinct light brownish gray (10YR 6/2 dry) silt and sand coatings on faces of peds; few fine fibrous roots; neutral; gradual smooth boundary.

C—52 to 60 inches; dark brown (10YR 3/3) loam; massive; friable; few fine fibrous roots; neutral.

The solum ranges from 30 to 56 inches in thickness. The upper 36 inches is loam or silt loam. The mollic epipedon is 36 to 60 inches thick. The A horizon has value of 2 or 3 and chroma of 1 or 2. The C horizon typically is loam, but in some pedons it is sandy clay loam or sandy loam.

Tama Series

The Tama series consists of well drained, moderately permeable soils on uplands. These soils formed in loess. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

The Tama soils in this county are taxadjuncts to the series because they do not have the increase in content of clay needed for an argillic horizon.

Typical pedon of Tama silt loam, 2 to 5 percent slopes, in a cultivated field; 620 feet east and 160 feet south of the northwest corner of sec. 24, T. 85 N., R. 3 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam (26 percent clay), dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; many fine fibrous roots; neutral; abrupt smooth boundary.

A1—7 to 13 inches; very dark brown (10YR 2/2) silt loam (26 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common medium and fine fibrous roots; neutral; gradual smooth boundary.

A2—13 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam (28 percent clay), brown (10YR 5/3) and dark grayish brown (10YR 4/2) dry; streaks and pockets of dark brown (10YR 3/3) in the lower part; weak fine subangular blocky structure; friable; few medium and fine fibrous roots; slightly acid; clear smooth boundary.

BA—18 to 23 inches; dark grayish brown (10YR 4/2) silty clay loam (28 percent clay), brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; few medium and fine fibrous roots; medium acid; gradual smooth boundary.

Bt1—23 to 30 inches; brown (10YR 4/3) silty clay loam (29 percent clay); moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—30 to 35 inches; brown (10YR 4/3) silty clay loam (29 percent clay); moderate fine angular and subangular blocky structure; friable; few distinct clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—35 to 41 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); common fine distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3) and few fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; few faint clay films on faces of peds; medium acid; gradual smooth boundary.

BC—41 to 46 inches; mottled brown (10YR 5/3), pale brown (10YR 6/3), and strong brown (7.5YR 5/6) silty clay loam (28 percent clay); weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

C—46 to 60 inches; mottled brown (10YR 5/3), pale brown (10YR 6/3), and strong brown (7.5YR 5/6) silt loam (21 percent clay); appears massive but has some vertical cleavage; friable; medium acid.

The solum ranges from 36 to 60 inches in thickness. The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. They are silt loam or silty clay loam. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 3 to 6.

Terril Series

The Terril series consists of moderately well drained, moderately permeable soils on foot slopes and alluvial fans. They formed in loamy, local alluvial sediments. The native vegetation was prairie grasses. Slope ranges from 2 to 9 percent.

Typical pedon of Terril loam, 5 to 9 percent slopes, in a cultivated field; 1,000 feet east and 150 feet north of the southwest corner of sec. 12, T. 86 N., R. 3 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—9 to 15 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual smooth boundary.

A2—15 to 22 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A3—22 to 32 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium and fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bw1—32 to 38 inches; dark brown (10YR 3/3) loam; weak medium and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw2—38 to 44 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw3—44 to 60 inches; dark yellowish brown (10YR 4/4) loam; few medium distinct light gray (10YR 7/1) and pale brown (10YR 6/3) mottles; weak fine subangular blocky structure; friable; few fine distinct yellowish red (5YR 4/6) soft accumulations of iron and manganese oxide; neutral.

The solum ranges from 36 to more than 60 inches in thickness. The content of sand throughout the solum ranges from 30 to 45 percent.

The A horizon is 24 to 36 inches thick. It has value of 2 or 3 and chroma of 1 or 2. It is loam, silt loam, or clay loam. The Bw horizon has value of 3 to 5 and chroma of 3 or 4. It is loam or clay loam.

Timula Series

The Timula series consists of well drained, moderately permeable soils on uplands. These soils formed in coarse loess. The native vegetation was deciduous trees. Slope ranges from 5 to 20 percent.

Typical pedon of Timula silt loam, 14 to 20 percent slopes, moderately eroded, in a cultivated field; 1,400 feet east and 100 feet north of the center of sec. 24, T. 86 N., R. 4 W.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, yellowish brown (10YR 5/4) dry; friable; streaks and pockets of yellowish brown (10YR 5/4) in the lower part; weak fine granular structure; neutral; abrupt smooth boundary.

BE—5 to 9 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; weak thin platy structure parting to weak fine granular; friable; neutral; clear smooth boundary.

Bw1—9 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium and fine subangular blocky structure; very friable; neutral; gradual smooth boundary.

Bw2—13 to 26 inches; yellowish brown (10YR 5/4) silt loam; moderate medium and fine subangular blocky structure; very friable; few faint light gray (10YR 7/2 dry) silt coatings on faces of peds; mildly alkaline; gradual smooth boundary.

Bw3—26 to 30 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; very friable; few faint light gray (10YR 7/2 dry) silt coatings on faces of peds; mildly alkaline; clear smooth boundary.

C1—30 to 38 inches; yellowish brown (10YR 5/4) silt loam; few fine prominent grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to weak fine angular and subangular blocky; very friable; mildly alkaline; strongly effervescent; clear smooth boundary.

C2—38 to 44 inches; yellowish brown (10YR 5/4) silt loam; few fine faint yellowish brown (10YR 5/6) and few fine prominent light olive brown (2.5Y 5/4) mottles; weak coarse prismatic structure parting to weak fine angular and subangular blocky; very friable; few fine dark soft accumulations of manganese and iron; mildly alkaline; strongly effervescent; clear smooth boundary.

C3—44 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; very friable; mildly alkaline; strongly effervescent.

The solum ranges from 20 to 36 inches in thickness. The Ap horizon typically has value of 3 to 5 and chroma of 2 to 5. The BE horizon has value of 4 to 6 and chroma of 2 to 4. The Bw horizon has value and chroma of 4 to 6. The content of clay in this horizon ranges from 10 to 18 percent.

Waubeek Series

The Waubeek series consists of well drained or moderately well drained, moderately permeable soils on uplands. These soils formed in about 20 to 40 inches of loess and in the underlying glacial till. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 2 to 14 percent.

Typical pedon of Waubeek silt loam, 2 to 5 percent slopes, in a cultivated field; 1,200 feet west and 1,080 feet south of the northeast corner of sec. 18, T. 86 N., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

E—7 to 10 inches; dark grayish brown (10YR 4/2) and dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) and brown (10YR 5/3) dry; weak medium platy structure parting to weak very fine subangular blocky; friable; few fine fibrous roots; neutral; clear smooth boundary.

Bt1—10 to 17 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; few faint clay films on faces of peds; few faint light gray (10YR 7/2 dry) silt coatings; few fine fibrous roots; slightly acid; clear smooth boundary.

Bt2—17 to 26 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam; moderate fine angular and subangular blocky structure; friable; few distinct clay films on faces of peds; few fine fibrous roots; medium acid; clear smooth boundary.

2Bt3—26 to 31 inches; yellowish brown (10YR 5/4) loam; weak fine and very fine subangular blocky structure; friable; few faint clay films on faces of peds; a stone line at a depth of about 31 inches; few fine fibrous roots; medium acid; clear smooth boundary.

2BC—31 to 42 inches; yellowish brown (10YR 5/4) loam; common fine faint yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many fine dark soft accumulations of iron and manganese oxide; few fine fibrous roots; few fine pebbles; strongly acid; gradual smooth boundary.

2C—42 to 60 inches; dark yellowish brown (10YR 4/4) loam; common fine distinct yellowish brown (10YR 5/6) mottles; appears massive but has some vertical cleavage; firm; few fine fibrous roots in the upper part; few fine pebbles; medium acid.

The solum ranges from 42 to 60 inches in thickness. The depth to carbonates ranges from 45 to 70 inches. The loess is 20 to 40 inches thick.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have a BE horizon. The E or BE horizon has chroma of 2 to 4. The 2Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 8. The 2Bt, 2BC, and 2C horizons are loam, sandy clay loam, or clay loam.

The Waubeek soils in map units 771C2 and 771D2 are taxadjuncts because they have a dark surface layer that is thinner than is defined as the range for the series.

Waukee Series

The Waukee series consists of well drained soils on stream terraces. These soils formed in 30 to 40 inches of loamy alluvium overlying sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Waukee loam, 0 to 2 percent slopes, in a cultivated field; 270 feet west and 180 feet north of the southeast corner of sec. 17, T. 86 N., R. 4 W.

Ap—0 to 8 inches; black (10YR 2/1) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

A1—8 to 16 inches; very dark brown (10YR 2/2) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure;

friable; medium acid; gradual smooth boundary.

A2—16 to 21 inches; very dark grayish brown (10YR 3/2) loam (21 percent clay), dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.

Bw1—21 to 32 inches; brown (10YR 4/3) loam (18 percent clay); weak fine subangular blocky structure; friable; strongly acid; gradual smooth boundary.

Bw2—32 to 35 inches; dark yellowish brown (10YR 4/4) sandy loam (18 percent clay); weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

2BC—35 to 37 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam (15 percent clay); weak fine subangular blocky structure; very friable; about 30 percent gravel; medium acid; clear smooth boundary.

2C—37 to 60 inches; yellowish brown (10YR 5/6) gravelly sand; single grain; loose; about 15 percent gravel; medium acid.

The solum ranges from 30 to 48 inches in thickness. The depth to sand and gravel ranges from 30 to 40 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam or silt loam. The Bw horizon has value of 4 or 5 and chroma of 3 to 6. It is loam or sandy clay loam. The content of clay in this horizon ranges from 18 to 27 percent. The 2C horizon is gravelly sand, loamy coarse sand, or sand. The content of gravel in this horizon typically is 10 to 20 percent, but in some pedons it is as much as 50 percent.

Waukegan Series

The Waukegan series consists of well drained soils on outwash areas and stream terraces. These soils formed in loess and in the underlying sand and gravel. Permeability is moderate in the upper part of the profile and very rapid in the lower part. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Waukegan silt loam, 0 to 2 percent slopes, in a cultivated field; 600 feet north and 1,620 feet west of the southeast corner of sec. 8, T. 85 N., R. 4 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine fibrous roots; neutral; abrupt smooth boundary.

A—7 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine fibrous roots; neutral; gradual smooth boundary.

BA—11 to 17 inches; dark brown (10YR 3/3) and brown (10YR 4/3) silt loam, brown (10YR 5/3) and yellowish brown (10YR 5/4) dry; moderate fine subangular blocky structure; friable; few very fine fibrous roots; slightly acid; clear smooth boundary.

Bw1—17 to 24 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; few very fine fibrous roots; slightly acid; gradual smooth boundary.

Bw2—24 to 33 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; few distinct light gray (10YR 7/2 dry) silt and fine sand coatings on vertical faces of peds; slightly acid; abrupt wavy boundary.

Bw3—33 to 37 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; common distinct light gray (10YR 7/2 dry) fine sand coatings on vertical faces of peds; slightly acid; abrupt wavy boundary.

2E&Bt—37 to 60 inches; yellowish brown (10YR 5/4 and 5/6) sand (E); single grain; loose; lamellae of dark yellowish brown (10YR 4/4) and strong brown (7.5YR 5/8) sandy loam (Bt); common pebbles in the lower part; neutral.

The solum ranges from 30 to 60 inches in thickness. The loess ranges from 20 to 40 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y and value and chroma of 3 to 5. It is silt loam or loam. The 2E&Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 6.

Whittier Series

The Whittier series consists of well drained soils on stream terraces. These soils formed in loess and in the underlying sandy sediments. Permeability is moderate in the upper part of the profile and rapid in the lower part. The native vegetation was deciduous trees and prairie grasses. Slope ranges from 1 to 5 percent.

Typical pedon of Whittier silt loam, 1 to 5 percent slopes, in a cultivated field; 1,260 feet east and 1,320 feet north of the southwest corner of sec. 20, T. 83 N., R. 3 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; few fine fibrous roots; slightly acid; abrupt smooth boundary.

E—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak very fine subangular blocky; friable; few fine fibrous roots; slightly acid; clear smooth boundary.

BE—11 to 14 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

Bt1—14 to 19 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; few distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; few fine fibrous roots; slightly acid; gradual smooth boundary.

Bt2—19 to 27 inches; brown (10YR 4/3) silty clay loam; moderate medium and fine subangular blocky structure; friable; few distinct clay films on faces of peds; few distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; few fine fibrous roots; neutral; gradual smooth boundary.

Bt3—27 to 35 inches; brown (10YR 4/3) silty clay loam; moderate medium and fine subangular blocky structure; friable; few distinct clay films on faces of peds; few distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; common distinct dark grayish brown (10YR 4/2) worm casts and coatings in root channels; few fine fibrous roots; neutral; gradual smooth boundary.

BC—35 to 40 inches; dark yellowish brown (10YR 4/4) loam; weak medium prismatic structure parting to moderate medium and fine angular and subangular blocky; friable; few distinct light gray (10YR 7/2 dry) silt coatings on faces of prisms; few fine fibrous roots; medium acid; abrupt wavy boundary.

2E&Bt—40 to 60 inches; brownish yellow (10YR 6/6) and yellowish brown (10YR 5/4) sand (E); single grain; loose; ½- to 2-inch lamellae of brown (7.4YR 4/4) sandy loam (Bt) at depths of 40, 48 and 55 inches; slightly acid.

The solum ranges from 30 to 48 inches in thickness. The depth to sandy material is 24 to 40 inches.

The A horizon has chroma of 1 or 2. The E horizon has chroma of 2 or 3. The BE and Bt horizons have value of 4 or 5 and chroma of 3 or 4. The 2E&Bt horizon is sand, loamy fine sand, or loamy sand.

Winneshiek Series

The Winneshiek series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in 20 to 40 inches of loamy glacial sediments and in a thin layer of residuum over limestone bedrock. The native vegetation was mixed deciduous trees and prairie grasses. Slope ranges from 2 to 18 percent.

Typical pedon of Winneshiek loam, 2 to 9 percent slopes, in a wooded area used as pasture; 30 feet east and 600 feet south of the northwest corner of sec. 8, T. 85 N., R. 2 W.

Ap—0 to 7 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; neutral; abrupt smooth boundary.

BE—7 to 11 inches; brown (10YR 4/3) and very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bt1—11 to 16 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few distinct clay films on faces of peds; few very dark grayish brown (10YR 3/2) coatings on faces of peds; neutral; gradual smooth boundary.

Bt2—16 to 20 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; few distinct clay films on faces of peds; few fine pebbles; neutral; clear smooth boundary.

Bt3—20 to 32 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; few distinct clay films on faces of peds; few fine pebbles; slightly acid; clear wavy boundary.

2Bt4—32 to 34 inches; brown (7.5YR 4/4) clay; moderate medium and fine subangular blocky structure; firm; common distinct clay films on faces of peds; some limestone fragments; slightly acid; abrupt wavy boundary.

2R—34 inches; hard, level-bedded limestone bedrock that is weathered in the upper few inches; small amounts of dark, clayey material between fragments in the upper few inches.

The solum ranges from 20 to 40 inches in thickness. The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, silt loam, or fine sandy loam. The Bt horizon has value and chroma of 3 or 4. It is loam or clay loam. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 3 to 8.

Worthen Series

The Worthen series consists of well drained, moderately permeable soils on alluvial fans and upland foot slopes. These soils formed in silty local alluvium. The native vegetation was prairie grasses. Slope ranges from 2 to 5 percent.

Typical pedon of Worthen silt loam, 2 to 5 percent slopes, in a cultivated field; 1,080 feet east and 1,140 feet north of the southwest corner of sec. 15, T. 83 N., R. 1 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine fibrous roots; neutral; abrupt smooth boundary.

Al—8 to 14 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

A2—14 to 21 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; few fine fibrous roots; neutral; gradual smooth boundary.

BA—21 to 28 inches; dark brown (10YR 3/3) silt loam; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; clear smooth boundary.

Bw—28 to 40 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; few fine fibrous roots; neutral; gradual smooth boundary.

BC—40 to 48 inches; brown (10YR 4/3) silt loam; weak medium and fine subangular blocky structure; friable; few distinct light gray (10YR 7/2 dry) silt coatings on vertical faces of peds; neutral; gradual smooth boundary.

C—48 to 60 inches; brown (10YR 4/3) silt loam; massive; friable; slightly acid.

The solum ranges from 40 to 60 inches in thickness. The mollic epipedon is 24 to 36 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The BA horizon has value of 3 or 4. The Bw horizon has value of 3 or 4 and chroma of 2 to 4. The content of clay in this horizon ranges from 18 to 24 percent. The C horizon has value of 4 or 5 and chroma of 3 to 6.

Formation of the Soils

This section relates the factors of soil formation to the soils in Jones County and describes the processes that result in the formation of soil horizons.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material. Human activities also affect soil formation.

Climate and plant and animal life, chiefly plants, are the active factors in the formation of soil. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a soil with genetically related horizons. The effects of climate and plant and animal life 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. Finally, time is needed for the changing of parent material into a soil profile. It may be a long or brief period of time, 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 factor unless conditions are specified for the other four.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. Some thin layers of several soils in the county formed as a result of the weathering of limestone 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, or gravity.

The principal kinds of parent material in Jones County are loess, alluvium, residuum, glacial till, and sandy eolian material. Of much less extent are deposits of organic material.

Loess, which is silty material deposited by the wind, covers about 42 percent of the county. It ranges in depth from about 10 to 30 feet on the more stable ridges to a thin mantle of 4 to 10 feet on the side slopes. It overlies glacial till, limestone bedrock, or both. According to Ruhe *(8)*, the base of the Wisconsin-age loess in Iowa ranges in age from about 16,500 to 29,000 years. Loess consists mainly of silt and some clay. It does not contain coarse sand or gravel, which was too large to be moved by wind, but it does contain small amounts of fine and very fine sand, generally less than 15 percent. Atterberry, Downs, Exette, Fayette, Muscatine, Orwood, Tama, and Timula soils formed in loess more than 60 inches thick. Dinsdale, Franklin, Klinger, and Waubeek soils formed where the loess is less than 40 inches deep over glacial till. Ripon and Dubuque soils formed where the loess is less than 40 inches deep over limestone. Nordness soils formed in very thin deposits of loess underlain by limestone bedrock.

Alluvium consists of sediments that have been deposited by water. Alluvial deposits of late Wisconsin age are on the flood plains and terraces in Jones County. About 19 percent of the soils formed in alluvial material, mostly along the North Fork Maquoketa River, the Maquoketa River, the Wapsipinicon River, Silver Creek, West Kitty Creek, Bear Creek, North Fork Walnut Creek, Buffalo Creek, and tributaries of these streams. Large flood plains are along the Maquoketa River and the Wapsipinicon River, and a stream terrace of about 1,800 acres is along the convergence of Kitty Creek and West Kitty Creek near the town of Monticello.

Much of the alluvium in this county eroded from soils on loess-covered slopes in the uplands, particularly on the steeper terrain. Many of the alluvial sediments are stratified silty soils low in content of sand. Examples of silty soils that formed in alluvium are the Arenzville, Chaseburg, Colo, Orion, Ossian, and Sawmill soils. Loamy soils that formed in alluvium but that contain more sand than the silty soils are the Coland, Marshan, Shandep, and Spillville soils.

Textural differences in the alluvial soils are accompanied by some differences in chemical and mineralogical composition of the alluvium. Some soils that formed in recently deposited alluvium, particularly in narrow limestone-controlled valleys, may be calcareous. Most alluvial soils on flood plains, however, are free of carbonates and typically are neutral to medium acid.

Some of the alluvial material has been transported only a short distance and has accumulated at the foot of the slope on which it originated. This material is called local alluvium and retains many characteristics of the soils in the areas from which it has eroded. Clyde, Colo, Ely, Floyd, Judson, Terril, and Worthen are examples of soils that formed in local alluvium and are on foot slopes or alluvial fans directly below glacial or loess-derived soils.

The soils on terraces also consist of alluvium or sediments overlying alluvium. They vary in texture. They are above the present flood plain and generally are not subject to flooding. Most are underlain by coarser textured material at a depth of 2 to 6 feet. Curran, Raddle, Waukegan, and Whittier soils formed in silty alluvium on terraces. Hayfield, Lawler, Saude, Sattre, and Waukee soils formed in loamy alluvium. Finchford, Flagler, and Billet soils formed in coarse textured material over coarse sand and gravel. Some alluvial terraces are loess covered, and the coarse textured material is commonly at a depth of 6 to 12 feet. Atterberry, Downs, and Fayette soils on benches formed in silty sediments (loess) over coarse sand and gravel.

A few of the alluvial soils on terraces and in outwash areas formed in depressional areas and typically have a seasonal high water table at or near the surface. Aquolls, ponded, and Brady, Granby, and Palms soils commonly are in these depressional areas.

Residuum is material derived from the weathering of sedimentary rocks in place. Limestone is the type of sedimentary bedrock in the county (fig. 15). In most places a deposit of loess or glacial drift covers the residuum. In a few areas where erosion has been severe, residuum makes up the entire solum. In Jones County the layer of residuum is generally less than 6 inches thick over bedrock. In places there is no residuum. A deposit of loess covers the thin layer of residuum in Ripon, Dubuque, and Nordness soils. Rockton, Emeline, and Winneshiek soils formed in loamy material over residuum and limestone bedrock. Backbone soils formed in coarse textured material over residuum. In some areas thin layers of glacial drift are above and interbedded in the upper part of the residuum. The residuum commonly is silty clay or clay and has a reddish hue.

Glacial till is all rock material transported by glacial ice, all deposits made by glacier ice, and all deposits of dominantly glacial origin deposited in bodies of glacial meltwater. Glacial till is unsorted sediment, the particles of which range in size from boulders to clay. The first of the glacial advances over the county was the Nebraskan glacier, which occurred about 750,000 years ago *(4)*. It was followed by the Kansan glacier, which began about 500,000 years ago. A more recent glaciation, the Iowan substage of the Wisconsin Glaciation, was recognized in a study by Leighton *(5)*, but recent studies of the presence and identification of Iowan glacial till indicate that the conclusions formed from studies made before 1960 are questionable. Intensive, detailed geomorphic and stratigraphic work shows that the landscape is a multilevel sequence of erosion surfaces and that many of the levels are cut into the Kansan and Nebraskan till.

Glacial till is fairly extensive in Jones County, making up about 26 percent of the total area. In most of the county, 3 to 15 feet of loess overlies the till. The glacial till in the loess-mantled areas commonly is exposed only where erosion has removed the loess, mainly on steep nose slopes and side slopes, or in saddles between loess-covered ridges. The Lindley soils formed in the loam and clay loam glacial till in these areas.

The Iowa Erosion Surface, mainly in the northwest and southwest corners of the county, is in a series of stepped interfluves above the present drainage system. It is commonly marked by a stone line where it cuts through the Kansan till. The stone line is on all levels of the stepped surfaces, and it passes under the alluvium along the drainageways. It typically separates the friable, loamy surficial sediments from the firm loam or clay loam glacial till. Bassett, Clyde, Floyd, Kenyon, and Ostrander soils formed in the loamy mantle over glacial till or till-derived sediment (fig. 16). The loamy overburden on the Clyde and Floyd soils in upland drainageways is thicker than on the upland, glacial-derived soils. Rockton and Winneshiek soils formed in loamy till-derived sediment underlain by limestone

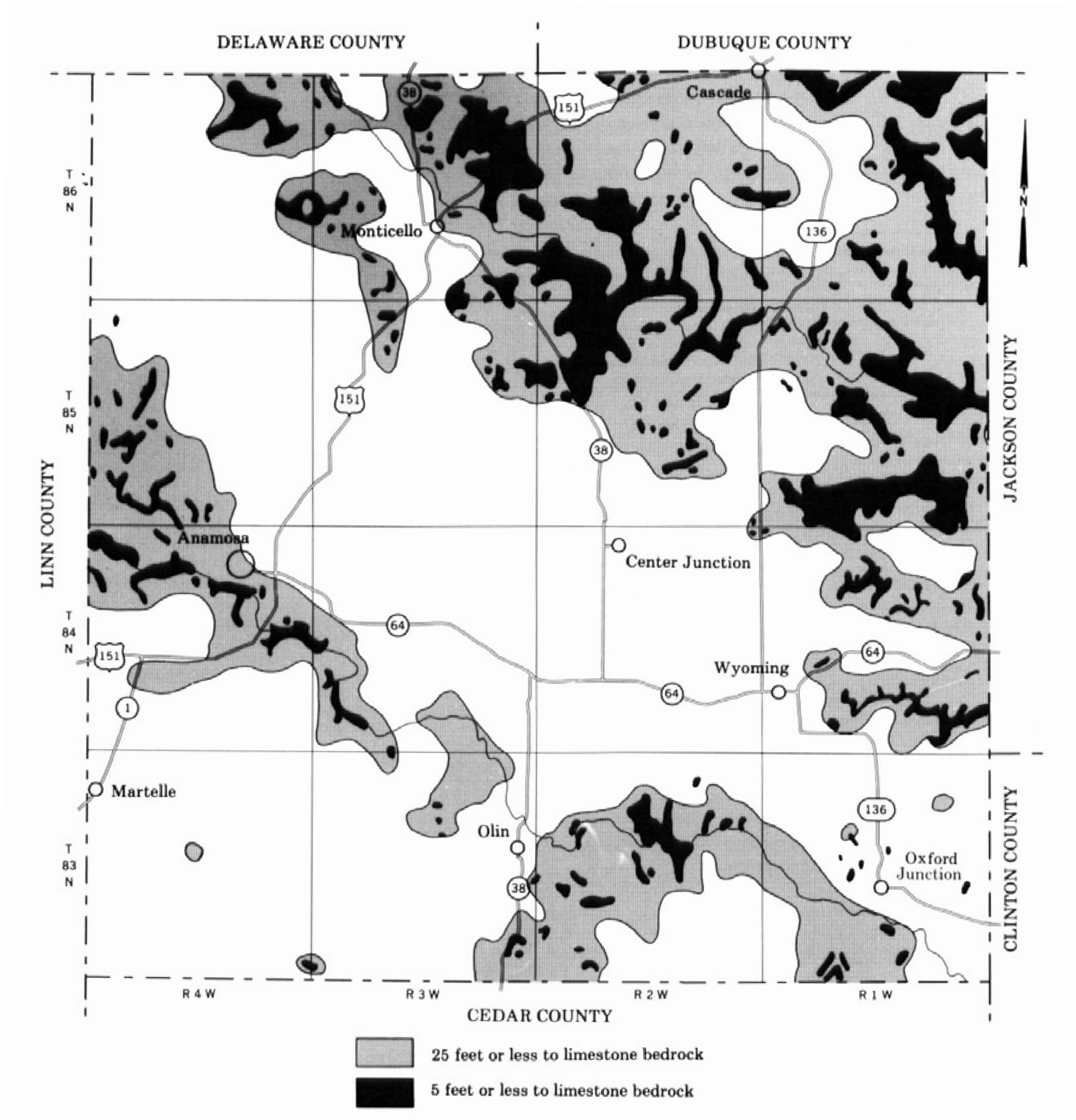

Figure 15.—The depth to bedrock in Jones County.

bedrock at a depth of 20 to 40 inches.

Pockets of coarse textured material commonly are throughout the glacial till, but most of them are small. Boulders ranging mostly from 3 to 10 feet in diameter are common on the surface or are buried in areas mantled by glacial till. Boulders and stones 6 to 30

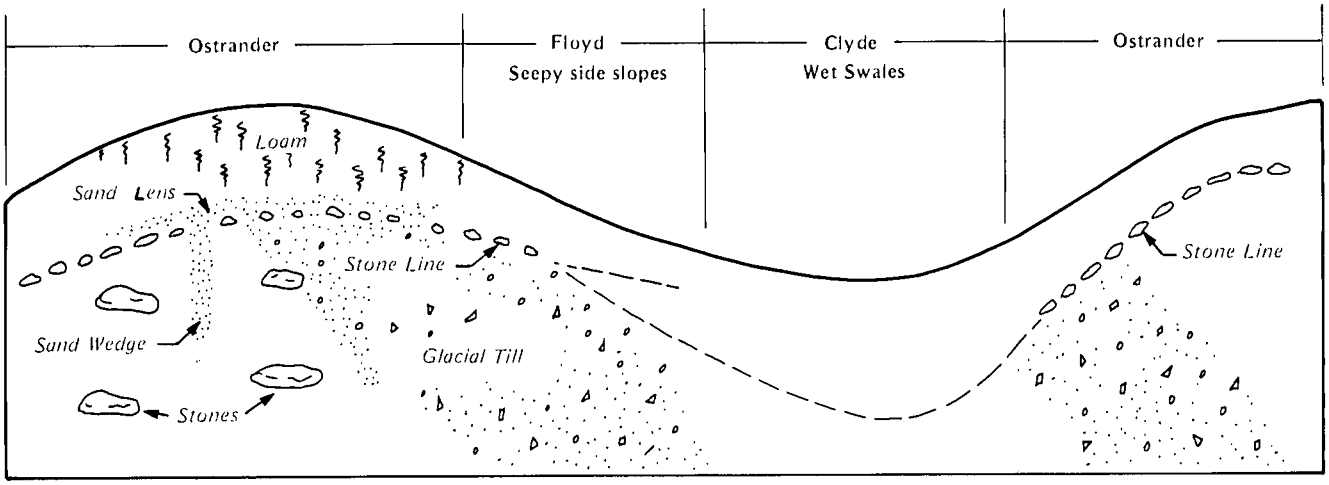

Figure 16.—The parent material of Ostrander, Floyd, and Clyde soils.

inches in diameter are concentrated in some of the supland drainageways, particularly in Clyde and Floyd soils. The boulders and stones commonly interfere with field cultivation or subsurface excavation of the soils.

Sandy eolian material is not extensive in Jones County. Depositional areas are mainly along the valleys of the major streams, occur on glacial till uplands as low mounds or dunes underlain by glacial till, and are intermingled with areas of soils that formed in loess. The sand is mainly quartz, which is very fine and fine in size and is highly resistant to weathering. It has not been altered appreciably since it was deposited.

Ankeny, Dickinson, and Sparta soils formed in sandy eolian material on benches along the major streams. Chelsea, Dickinson, Lamont, and Sparta soils formed in thick, wind-deposited sand on uplands, commonly on the east or southeast side of the major streams. Olin soils formed in wind-deposited sandy loam underlain by glacial till at a depth of 2 to 4 feet. Backbone and Bertram soils formed in wind-deposited sandy loam underlain by limestone bedrock at a depth of 20 to 40 inches. Bolan and Orwood soils formed in wind-deposited loamy material on uplands.

Organic material is the parent material of muck and peat. Mucky soils are characterized by organic plant remains that are more thoroughly decomposed than those in peat. They commonly are in small wet areas where poor drainage has retarded the decay of plant remains that have accumulated over a period of time. The wet areas may be in upland drainageways, on sidehill seeps in the uplands, or in depressions on uplands, in outwash areas, or on stream terraces. The organic material in the county generally is about 18 to 50 inches deep over a mineral soil, but a few deposits are thicker. The mucky Palms soils formed in this organic material.

Climate

The soils in Jones County formed under a midcontinental, subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate favored the growth of forest vegetation *(7)*. The morphology of most of the soils indicates that the climate under which the soils formed is similar to the present one. The climate generally is 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 the characteristics of soils. It affects the rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil. Temperature, rainfall, relative humidity, and length of the frost-free period affect the kind of vegetation on the soil.

Local conditions somewhat modify the effect of the general climate of a region on soil formation. For example, the microclimate on south-facing slopes is warmer and less humid than that on north-facing slopes. Poorly drained soils in low areas are wetter and colder than most of the surrounding upland soils. These local conditions account for some of the differences among the soils in the county.

Plant and Animal Life

The main living organisms include vegetation, animals, bacteria, and fungi. Plant life is especially significant to soil formation because it helps to initiate the process. As they grow and die, plants add organic matter to the surface layer of the soil, help determine the color of the surface, and add nutrients to the soil.

The native prairie grasses and the water-tolerant grasses, which had an abundance of fibrous roots that extended to a depth of 10 to 20 inches, created a thick, dark surface layer in many soils in Jones County. Kenyon, Sawmill, and Tama soils are examples of soils formed under prairie grasses. Trees commonly feed on plant nutrients deep in the subsoil. As a result, they add little organic matter to the surface layer other than that from fallen leaves and decaying branches or trunks. The soils that formed under timber vegetation have a thinner, lighter colored surface layer than those that formed under grasses. Chelsea, Dubuque, Fayette, Lamont, and Lindley soils formed under trees. Many soils formed first under prairie grasses and then under a combination of prairie grasses and trees. This process created properties intermediate between those soils formed entirely under prairie grasses or entirely under trees. Bassett, Downs, and Orwood soils formed under mixed prairie grasses and timber.

Tama, Downs, and Fayette soils are members of a biosequence, or a group of soils that formed in the same parent material and under similar environmental conditions, that supported different kinds of native vegetation. Tama soils formed under prairie grasses, Downs soils under mixed grasses and trees, and Fayette soils under trees. The main morphological differences among the three soils are the result of the different kinds of native vegetation.

The activities of burrowing animals and insects keep the upper few feet of the soil loose and porous. Bacteria and fungi aid in the decomposition of the vegetation and thus in the release of plant nutrients.

Relief

Relief, or topography, affects soil formation mainly through its effect on drainage, runoff, and erosion. The relief in Jones County ranges from nearly level to very steep.

Many nearly level areas on bottom land are frequently flooded and have a high water table. Water soaks into the nearly level areas on uplands and high stream terraces that are not flooded, and many of these areas have a high water table. The soils formed in these areas typically have a dark grayish brown to olive gray subsoil. Clyde, Colo, Marshan, and Maxfield soils are examples of nearly level, poorly drained soils.

Much of the rainfall runs off the surface of more sloping areas and less penetrates the soil, resulting in moderately well drained or well drained soils. Downs, Fayette, and Kenyon soils, which formed in areas where runoff is medium or rapid and where the water table was below the subsoil, generally have a yellowish brown subsoil. Some areas of nearly level to gently sloping soils, particularly on broad upland divides or wide stream terraces, have imperfect or intermediate drainage and a seasonal high water table. The somewhat poorly drained soils that formed in these areas, such as Atterberry, Curran, Floyd, Franklin, Hayfield, and Muscatine soils, typically have a mottled grayish brown subsoil. Many of the very steep soils, such as Emeline soils, have weakly expressed profiles because most of the precipitation that they receive runs off the surface.

Of the soils that formed under prairie grasses, those that have a higher water table generally have more organic matter in the surface layer than those that have good natural drainage. Depressional areas that collect and impound water generally contain poorly drained or very poorly drained soils that have a distinct, lighter colored subsurface layer and a gray subsoil. Ansgar, Granby, and Shandep soils are examples of soils that formed in depressional areas.

Downs, Fayette, Orwood, and similar soils that have a wide slope range have some properties that change as slope increases. These properties include the thickness of the surface layer, the maximum percentage of clay in the B horizon and the depth to the clay maximum, and the depth to carbonates. The surface layer typically is thinner in the more sloping soils as the result of erosion and soil movement. The maximum percentage of clay in the B horizon and the depth to the clay maximum decrease with increasing slope gradient as a result of a reduction in the thickness of the surface layer. Carbonates are closer to the surface in the steeper areas. In some areas of Timula soils and in other areas where soil loss commonly has been severe, the carbonates are at or near the surface.

Aspect significantly affects soil formation. South-facing slopes generally are warmer and drier than north-facing slopes and consequently support a different kind and amount of vegetation.

The influence of a porous, rapidly permeable parent material may override the influence of topography. Even though Billet, Chelsea, Flagler, and Sparta soils, for example, may be no more than gently sloping or moderately sloping, they are excessively drained or somewhat excessively drained because they are moderately rapidly permeable or rapidly permeable in the upper part and very rapidly permeable in the lower part. These coarse textured soils have slower runoff even on the steeper slopes, but they may be subject to wind erosion if vegetation is sparse.

Kenyon, Clyde, Floyd, and Ostrander soils, all of which formed in the same kind of parent material and under similar vegetation, differ because of slight differences in topographic position. Their microrelief affects runoff and depth to the water table. The moderately well drained Kenyon and well drained Ostrander soils are on gently sloping to strongly sloping upland ridges and side slopes. The somewhat poorly drained, very gently sloping Floyd soils are in slightly concave areas adjacent to upland drainageways. The nearly level, poorly drained Clyde soils are in upland drainageways.

Judson, Terril, and Worthen soils are on foot slopes and in some upland drainageways. Their properties are similar to those of the upslope soils from which they receive sediments.

Time

The length of time that the soil material remains in place and is acted upon by the soil-forming processes affects the kind of soil that forms. The amount of time necessary ranges from a few days for the formation of fresh alluvial deposits, such as in the units shown on the maps as Perks-Chaseburg complex, 0 to 2 percent slopes, to 1,000 years or more for the subsoil in many of the older upland soils. The older soils, such as Downs and Fayette soils, have strongly expressed genetic horizons. The younger soils, such as those that formed in sandy eolian material or in recently deposited alluvium, have only weakly expressed horizons. They have not been in place long enough for the climate and vegetation to develop well defined genetic horizons.

If other factors are favorable, the texture of the subsoil generally becomes finer and a greater amount of soluble material is leached out of the profile as the soils continue to weather. However, the resistance of soil material to weathering can modify the effect of time. Soils that formed in quartz sand, such as the Chelsea and Sparta soils, do not change much with time. Other exceptions are steep soils, such as Nordness soils, that have a small amount of water infiltration and a large amount of runoff. Such soils weather much more slowly than soils in stable, less sloping areas.

Where carbon-bearing organic material, such as trees and prairie grasses, has been buried through the action of glacial ice, flooding, or wind, the age of a landscape can be determined by a process known as radiocarbon dating *(9)*. Studying the different landscape positions and exposure of different kinds of parent material as a result of erosion can also provide a comparative dating of the various kinds of material on the landscape.

The loess in which the Downs, Fayette, Orwood, Tama, and Timula soils of this region formed is about 14,000 to 20,000 years old. Recent studies show that the Iowa Erosion Surface, beneath the loess formed during the period of loess deposition and as a result could be as young as 14,000 years old. Bassett, Kenyon, and Ostrander soils are in the higher areas on this surface. They are older than Clyde and Floyd soils, which are cut in and on a lower landscape position. The surface not covered by loess could be younger than the loess, and in areas where it is covered by loamy sediments, the surface is less than 14,000 years old. Time is needed for soil formation, but the age of the parent material does not necessarily reflect the true age of the soil profile that formed in that material.

Human Activities

Changes in the soil took place after the pioneers settled Jones County. Some of these had major effects on soil productivity. Breaking the prairie sod and clearing the timber removed and changed the protective plant cover. Cultivation increased the susceptibility of the more sloping soils to erosion, which removed topsoil, organic matter, and plant nutrients. Sheet erosion, which is the most prevalent kind of erosion in the county, removes a few inches of topsoil at one time. Cultivation generally destroys most evidence of this loss. In some areas, shallow and deep gullies have formed and the eroded soil material has been deposited on the lower slopes or totally removed by streamflow. As the land was brought under cultivation, the runoff rate increased and the rate at which water moved into the soil decreased. As a result, accelerated erosion removed part or all of the original surface layer from many of the more sloping soils.

Cultivation and erosion also change the structure and consistence of the surface layer of some soils. The well developed granular structure of the surface layer, apparent in soils that formed under prairie grasses, breaks down when the soils are intensively cropped. The surface layer generally becomes hard and dry. The fine textured soils that have been plowed many times during wet periods tend to puddle and are more slowly permeable than similar soils in uncultivated areas. Even in areas that are not subject to erosion, compaction by heavy machinery can reduce the thickness of the surface layer and change the soil structure. In moderately eroded areas less friable, finer textured subsoil material generally is mixed into the surface layer. In many severely eroded areas, the thin plow layer includes mostly subsoil material. The organic matter content and level of fertility in these soils are greatly reduced, and the hazard of further erosion is severe.

Eroded soil material from hillsides commonly is deposited in the lower areas. For example, Arenzville and Chaseburg soils, which formed in recent alluvium, have strata of light- and dark-colored soil material washed from the hillsides. In many areas these deposits range mainly from 20 to 60 inches in thickness and consist of stratified material over a dark buried soil that formed prior to cultivation.

Wind erosion also occurs after a soil is cultivated. Light-textured soils are highly susceptible to wind erosion, especially if the surface is bare and the topsoil is dry. Windblown sand grains can extensively damage crops, especially new seedlings. Wind erosion also deposits sediments in road ditches, which must be cleaned to ensure proper land drainage. This problem is most evident following fall plowing, as dark topsoil is mixed with snow in fence rows and ditches.

Some management measures decrease the susceptibility to erosion, increase soil productivity, and reclaim areas generally not suitable for crops or hay. For example, large areas on bottom land are suitable for cultivation if flooding and deposition are controlled by diversions at the base of slopes, by drainage ditches, or by levees. Many soils can be made more productive than they were naturally if commercial fertilizers and lime are applied to overcome deficiencies in plant nutrients. In some areas terraces, contour stripcropping, and other conservation practices can control erosion and runoff. Although these measures cannot increase the organic matter content of the soils to the level that was characteristic of native grassland, conservation practices that control erosion can keep the content at a level that is needed to maintain crop growth.

Processes of Soil Formation

Horizon differentiation is the result of four basic processes. These are additions, removals, transfers, and transformations. Each of these processes affects many substances in the soils, such as organic matter, calcium carbonates, sesquioxides or iron, and silicate clay minerals. In most soils more than one of these processes have been active in the formation of horizons.

The accumulation of organic matter is an early phase in the formation of most soils. Generally, the soils that have a high content of organic matter, like Sawmill soils, also have a thick, dark surface layer. Soils with a thin, light-colored surface layer, like Fayette soils, have a low content of organic matter. In some soils the content of organic matter is low because erosion has removed part of the A horizon.

The removal of substances from parts of the profile has differentiated horizons in most of the soils in the county. The downward movement of calcium carbonates and bases is an example. Free carbonates have been leached from the upper part of nearly all of the soils with the exception of the Timula soils, which often have carbonate nodules throughout the profile, and some small areas of alluvial soils that formed in narrow limestone-controlled valleys. Some soils, particularly those formed in glacial till, have free carbonates in the lower part of the subsoil and in the substratum. Some soils are so strongly leached of carbonates that they are strongly acid or very strongly acid in the subsoil.

A number of substances are transferred from one horizon to another. Phosphorus, for example, is removed from the subsoil by plant roots and transferred to the parts of the plant growing above the ground. It is then added to the surface layer in the plant residue. This process affects the form and distribution of the phosphorus in the profile. Another kind of transfer occurs only in clayey soils when cracks form as these soils shrink and swell with wetting and drying cycles. As a result, some of the material from the surface layer is transferred through these cracks to the lower parts of the profile.

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

Transformations are physical and chemical. The weathering of soil particles to smaller sizes is an example of transformation. The reduction of iron, called gleying, is another example. It occurs when the soil is saturated for long periods and is evidenced by ferrous iron and gray colors in the subsoil. It is characteristic of poorly drained soils, such as Colo and Sawmill soils. Reductive extractable iron, or free iron, generally is not so evident in somewhat poorly drained soils, such as Curran soils. It commonly is strongly evident, however, in the lower part of the subsoil in some soils that formed in loess, such as Exette silt loam. The colors in these soils are called "relict" colors and are not indicative of present drainage conditions. Another kind of transformation is the weathering of the primary apatite mineral in the parent material to secondary phosphorus compounds. This process occurs in Colo and other soils that have a pH near 7. The supply of available phosphorus is higher in these soils than in Timula and other soils that have a pH of more than 7.

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Glossary

Accumulations (in soil profiles). Commonly dark, soft concentrations of mineral material that contrast with the surrounding soil in color and composition but are not easily separated as discrete bodies, although some have clearly defined boundaries. Most accumulations consist of calcium carbonates or iron and manganese oxides.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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—

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.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Benches (geologic). Higher, older terraces that are now a part of the erosion surface of the valley. In Iowa the benches are of pre-Wisconsin age and are covered by loess.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay 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 to 38 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 a protective amount of 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.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

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 frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

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.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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.

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.

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 meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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 7.6 centimeters) in diameter. An individual piece is a pebble.

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 uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon 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) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying 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, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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.

Lamellae. Thin, horizontal lenses or bands of sandy material within sandy eolian horizons that result from the cementation of sand grains by iron and clay minerals within the soil layer. These layers commonly are of contrasting textures to the surrounding material.

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.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, 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 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.

Paha. A prominent, loess-covered, elongated ridge or elliptical, moundlike hill oriented in a northwest to southeast direction on the Iowan Erosion Surface.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. 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.

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. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

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 substratum. 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 surface runoff.

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.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the 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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these 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.

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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

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 1951-84 at Anamosa, 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*	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-----	26.7	7.5	17.1	52	0	0	1.10	0.35	1.70	3	6.6
February----	33.0	13.6	23.3	56	0	0	1.19	.41	1.82	3	6.2
March-------	43.6	23.8	33.7	75	0	17	2.26	.99	3.33	6	7.6
April-------	60.2	36.5	48.4	86	15	86	3.57	2.12	4.86	8	1.6
May---------	72.2	47.0	59.6	90	27	316	4.02	2.27	5.57	8	.0
June--------	80.9	56.4	68.7	94	38	561	4.83	3.09	6.39	7	.0
July--------	85.0	60.8	72.9	97	43	710	4.15	2.36	5.73	7	.0
August------	83.2	58.7	71.0	95	41	651	3.85	1.65	5.72	7	.0
September---	75.2	49.9	62.6	93	28	378	3.55	1.37	5.36	6	.0
October-----	64.3	39.5	51.9	87	19	145	2.53	.63	4.02	5	.1
November----	46.9	27.3	37.1	71	1	6	2.08	.73	3.19	4	1.6
December----	32.8	15.3	24.1	60	1	0	1.48	.73	2.13	4	7.0
Yearly:											
Average----	58.7	36.4	47.5	---	---	---	---	---	---	---	---
Extreme----	---	---	---	97	1	---	---	---	---	---	---
Total------	---	---	---	---	---	2,870	34.61	28.18	40.69	68	30.7

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-84 at Anamosa, Iowa)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 23	May 11	May 27
2 years in 10 later than--	Apr. 19	May 6	May 22
5 years in 10 later than--	Apr. 11	Apr. 27	May 11
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 6	Sept. 23	Sept. 15
2 years in 10 earlier than--	Oct. 11	Sept. 28	Sept. 20
5 years in 10 earlier than--	Oct. 22	Oct. 8	Sept. 29

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-84 at Anamosa, 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	175	143	121
8 years in 10	181	150	127
5 years in 10	193	164	140
2 years in 10	204	177	153
1 year in 10	210	184	160

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
8B	Judson silt loam, 1 to 5 percent slopes	840	0.2
8C	Judson silt loam, 5 to 9 percent slopes	460	0.1
11B	Colo-Ely silty clay loams, 2 to 5 percent slopes	15,550	4.1
27B	Terril loam, 2 to 5 percent slopes	1,900	0.5
27C	Terril loam, 5 to 9 percent slopes	290	0.1
41B	Sparta loamy fine sand, 1 to 5 percent slopes	2,120	0.6
41C	Sparta loamy fine sand, 5 to 9 percent slopes	1,520	0.4
42	Granby fine sandy loam, 0 to 2 percent slopes	220	0.1
63B	Chelsea loamy fine sand, 2 to 5 percent slopes	720	0.2
63C	Chelsea loamy fine sand, 5 to 9 percent slopes	1,790	0.5
63F	Chelsea loamy fine sand, 9 to 30 percent slopes	1,310	0.3
65C2	Lindley loam, 5 to 9 percent slopes, moderately eroded	360	0.1
65E2	Lindley loam, 9 to 18 percent slopes, moderately eroded	350	0.1
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded	330	0.1
83B	Kenyon loam, 2 to 5 percent slopes	4,960	1.3
83C	Kenyon loam, 5 to 9 percent slopes	650	0.2
83C2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	480	0.1
84	Clyde silty clay loam, 0 to 2 percent slopes	6,950	1.9
109C	Backbone sandy loam, 5 to 9 percent slopes	360	0.1
109E	Backbone sandy loam, 9 to 18 percent slopes	350	0.1
110B	Lamont fine sandy loam, 2 to 5 percent slopes	290	0.1
110C	Lamont fine sandy loam, 5 to 9 percent slopes	430	0.1
110E	Lamont fine sandy loam, 9 to 18 percent slopes	230	0.1
118	Garwin silty clay loam, 0 to 2 percent slopes	1,890	0.5
119B	Muscatine silt loam, 1 to 4 percent slopes	4,850	1.3
120B	Tama silt loam, 2 to 5 percent slopes	7,180	1.9
120C	Tama silt loam, 5 to 9 percent slopes	1,490	0.4
129B	Arenzville-Chaseburg silt loams, 2 to 5 percent slopes	13,170	3.4
133	Colo silty clay loam, 0 to 2 percent slopes	2,140	0.6
136	Ankeny fine sandy loam, 0 to 2 percent slopes	570	0.2
142	Chaseburg silt loam, 0 to 2 percent slopes	4,890	1.3
143B	Brady sandy loam, 1 to 4 percent slopes	410	0.1
152	Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,550	0.4
153	Shandep loam, 0 to 1 percent slopes	250	0.1
159	Finchford loamy sand, 0 to 2 percent slopes	260	0.1
159C	Finchford loamy sand, 2 to 9 percent slopes	340	0.1
162B	Downs silt loam, 2 to 5 percent slopes	3,380	0.9
162C	Downs silt loam, 5 to 9 percent slopes	7,940	2.1
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	4,960	1.3
162D	Downs silt loam, 9 to 14 percent slopes	1,960	0.5
162D2	Downs silt loam, 9 to 14 percent slopes, moderately eroded	5,530	1.5
163B	Fayette silt loam, 2 to 5 percent slopes	870	0.2
163C	Fayette silt loam, 5 to 9 percent slopes	10,560	2.8
163C2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	8,450	2.3
163D	Fayette silt loam, 9 to 14 percent slopes	1,560	0.4
163D2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	29,820	7.8
163E	Fayette silt loam, 14 to 18 percent slopes	3,370	0.9
163E2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	11,340	3.0
163F	Fayette silt loam, 18 to 25 percent slopes	8,650	2.3
163F2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	9,930	2.7
163G	Fayette silt loam, 25 to 40 percent slopes	7,220	1.9
171B	Bassett loam, 2 to 5 percent slopes	1,750	0.5
171C	Bassett loam, 5 to 9 percent slopes	940	0.3
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	1,660	0.4
171D	Bassett loam, 9 to 14 percent slopes	270	0.1
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded	1,570	0.4
171E2	Bassett loam, 14 to 18 percent slopes, moderately eroded	290	0.1
174B	Bolan loam, 2 to 5 percent slopes	2,480	0.7
174C	Bolan loam, 5 to 9 percent slopes	630	0.2
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	1,590	0.4
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	780	0.2
177	Saude loam, 0 to 2 percent slopes	360	0.1
177B	Saude loam, 2 to 5 percent slopes	310	0.1
178	Waukee loam, 0 to 2 percent slopes	1,170	0.3
178B	Waukee loam, 2 to 5 percent slopes	370	0.1

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
184B	Klinger silt loam, 1 to 4 percent slopes	4,980	1.3
198B	Floyd loam, 1 to 4 percent slopes	6,510	1.7
221	Palms muck, 0 to 3 percent slopes	210	0.1
226	Lawler silt loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	890	0.2
246	Curran silt loam, 0 to 2 percent slopes	1,960	0.5
246B	Curran silt loam, 2 to 5 percent slopes	1,300	0.3
284B	Flagler sandy loam, 1 to 5 percent slopes	380	0.1
290	Dells silt loam, 0 to 2 percent slopes	410	0.1
291B	Atterberry silt loam, 1 to 4 percent slopes	1,790	0.5
293C	Chelsea-Lamont-Fayette complex, 2 to 9 percent slopes	3,430	0.9
293D	Chelsea-Lamont-Fayette complex, 9 to 14 percent slopes	2,660	0.7
293F	Chelsea-Lamont-Fayette complex, 14 to 25 percent slopes	2,060	0.6
315	Perks-Chaseburg complex, 0 to 2 percent slopes	12,900	3.4
320	Arenzville silt loam, 0 to 2 percent slopes	3,190	0.9
350	Waukegan silt loam, 0 to 2 percent slopes	270	0.1
350B	Waukegan silt loam, 2 to 5 percent slopes	620	0.2
351	Atterberry silt loam, sandy substratum, 0 to 2 percent slopes	1,210	0.3
352B	Whittier silt loam, 1 to 5 percent slopes	570	0.2
354	Aquolls, ponded	320	0.1
377B	Dinsdale silt loam, 2 to 5 percent slopes	10,590	2.8
377C	Dinsdale silt loam, 5 to 9 percent slopes	1,910	0.5
377C2	Dinsdale silt loam, 5 to 9 percent slopes, moderately eroded	910	0.2
381B	Klinger-Maxfield complex, 1 to 4 percent slopes	940	0.3
382	Maxfield silty clay loam, 0 to 2 percent slopes	1,030	0.3
391B	Clyde-Floyd complex, 1 to 4 percent slopes	6,590	1.8
394B	Ostrander loam, 2 to 5 percent slopes	6,150	1.6
394C	Ostrander loam, 5 to 9 percent slopes	1,640	0.4
408B	Olin fine sandy loam, 2 to 5 percent slopes	670	0.2
408C	Olin fine sandy loam, 5 to 9 percent slopes	520	0.1
412C	Emeline loam, 2 to 9 percent slopes	1,270	0.3
412E	Emeline loam, 9 to 18 percent slopes	790	0.2
428B	Ely silty clay loam, 2 to 5 percent slopes	1,250	0.3
462B	Downs silt loam, benches, 2 to 5 percent slopes	780	0.2
462C	Downs silt loam, benches, 5 to 9 percent slopes	250	0.1
463B	Fayette silt loam, benches, 2 to 5 percent slopes	820	0.2
463C	Fayette silt loam, benches, 5 to 9 percent slopes	380	0.1
478G	Nordness-Rock outcrop complex, 18 to 60 percent slopes	6,200	1.7
480C	Orwood silt loam, 5 to 9 percent slopes	1,450	0.4
480C2	Orwood silt loam, 5 to 9 percent slopes, moderately eroded	1,040	0.3
480D	Orwood silt loam, 9 to 14 percent slopes	590	0.2
480D2	Orwood silt loam, 9 to 14 percent slopes, moderately eroded	1,430	0.4
480E	Orwood silt loam, 14 to 18 percent slopes	410	0.1
480E2	Orwood silt loam, 14 to 18 percent slopes, moderately eroded	640	0.2
480F2	Orwood silt loam, 18 to 25 percent slopes, moderately eroded	490	0.1
484	Lawson silt loam, 0 to 2 percent slopes	650	0.2
485	Spillville loam, 0 to 2 percent slopes	1,330	0.4
489	Ossian silt loam, 0 to 2 percent slopes	4,610	1.2
499D	Nordness loam, 5 to 14 percent slopes	1,070	0.3
499F	Nordness loam, 14 to 30 percent slopes	2,950	0.8
539	Perks sandy loam, 0 to 2 percent slopes	650	0.2
585	Spillville-Coland complex, 0 to 2 percent slopes	5,900	1.6
626	Hayfield loam, 0 to 2 percent slopes	890	0.2
673D2	Timula silt loam, 5 to 14 percent slopes, moderately eroded	530	0.1
673E2	Timula silt loam, 14 to 20 percent slopes, moderately eroded	470	0.1
703D	Dubuque silt loam, 5 to 14 percent slopes	250	0.1
703F	Dubuque silt loam, 14 to 25 percent slopes	690	0.2
760	Ansgar silt loam, 0 to 1 percent slopes	340	0.1
761B	Franklin silt loam, 1 to 4 percent slopes	2,050	0.5
763D2	Exette silt loam, 9 to 14 percent slopes, moderately eroded	870	0.2
763E2	Exette silt loam, 14 to 18 percent slopes, moderately eroded	3,950	1.1
763F2	Exette silt loam, 18 to 25 percent slopes, moderately eroded	6,310	1.7
771B	Waubeek silt loam, 2 to 5 percent slopes	5,650	1.5
771C	Waubeek silt loam, 5 to 9 percent slopes	4,250	1.1
771C2	Waubeek silt loam, 5 to 9 percent slopes, moderately eroded	490	0.1
771D	Waubeek silt loam, 9 to 14 percent slopes	590	0.2

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
771D2	Waubeek silt loam, 9 to 14 percent slopes, moderately eroded	230	0.1
775B	Billett sandy loam, 2 to 5 percent slopes	370	0.1
775D	Billett sandy loam, 5 to 14 percent slopes	680	0.2
775E	Billett sandy loam, 14 to 20 percent slopes	220	0.1
778	Sattre loam, 0 to 2 percent slopes	450	0.1
778B	Sattre loam, 2 to 5 percent slopes	430	0.1
809B	Bertram fine sandy loam, 2 to 5 percent slopes	230	0.1
809C	Bertram fine sandy loam, 5 to 9 percent slopes	390	0.1
814B	Rockton loam, 2 to 5 percent slopes	1,280	0.3
814C	Rockton loam, 5 to 9 percent slopes	740	0.2
817C	Ripon silt loam, 2 to 7 percent slopes	470	0.1
914C	Winneshiek loam, 2 to 9 percent slopes	1,070	0.3
914E	Winneshiek loam, 9 to 18 percent slopes	480	0.1
930	Orion silt loam, 0 to 2 percent slopes	740	0.2
933	Sawmill silty clay loam, 0 to 2 percent slopes	8,500	2.3
976	Raddle silt loam, 0 to 2 percent slopes	1,140	0.3
976B	Raddle silt loam, 2 to 5 percent slopes	430	0.1
981B	Worthen silt loam, 2 to 5 percent slopes	1,350	0.4
1291	Atterberry silt loam, benches, 0 to 2 percent slopes	900	0.2
1291B	Atterberry silt loam, benches, 2 to 5 percent slopes	620	0.2
5010	Pits, sand and gravel	250	0.1
5030	Pits, limestone quarries	500	0.1
5040	Orthents, loamy	590	0.2
	Water	2,290	0.6
	Total	374,400	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
8B	Judson silt loam, 1 to 5 percent slopes
11B	Colo-Ely silty clay loams, 2 to 5 percent slopes (where drained)
27B	Terril loam, 2 to 5 percent slopes
83B	Kenyon loam, 2 to 5 percent slopes
84	Clyde silty clay loam, 0 to 2 percent slopes (where drained)
110B	Lamont fine sandy loam, 2 to 5 percent slopes
118	Garwin silty clay loam, 0 to 2 percent slopes (where drained)
119B	Muscatine silt loam, 1 to 4 percent slopes
120B	Tama silt loam, 2 to 5 percent slopes
129B	Arenzville-Chaseburg silt loams, 2 to 5 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
133	Colo silty clay loam, 0 to 2 percent slopes (where drained)
136	Ankeny fine sandy loam, 0 to 2 percent slopes
142	Chaseburg silt loam, 0 to 2 percent slopes
143B	Brady sandy loam, 1 to 4 percent slopes
152	Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes (where drained)
153	Shandep loam, 0 to 1 percent slopes (where drained)
162B	Downs silt loam, 2 to 5 percent slopes
163B	Fayette silt loam, 2 to 5 percent slopes
171B	Bassett loam, 2 to 5 percent slopes
174B	Bolan loam, 2 to 5 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
177	Saude loam, 0 to 2 percent slopes
177B	Saude loam, 2 to 5 percent slopes
178	Waukee loam, 0 to 2 percent slopes
178B	Waukee loam, 2 to 5 percent slopes
184B	Klinger silt loam, 1 to 4 percent slopes
198B	Floyd loam, 1 to 4 percent slopes
226	Lawler silt loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
246	Curran silt loam, 0 to 2 percent slopes (where drained)
246B	Curran silt loam, 2 to 5 percent slopes (where drained)
290	Dells silt loam, 0 to 2 percent slopes
291B	Atterberry silt loam, 1 to 4 percent slopes
320	Arenzville silt loam, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
350	Waukegan silt loam, 0 to 2 percent slopes
350B	Waukegan silt loam, 2 to 5 percent slopes
351	Atterberry silt loam, sandy substratum, 0 to 2 percent slopes
352B	Whittier silt loam, 1 to 5 percent slopes
377B	Dinsdale silt loam, 2 to 5 percent slopes
381B	Klinger-Maxfield complex, 1 to 4 percent slopes (where drained)
382	Maxfield silty clay loam, 0 to 2 percent slopes (where drained)
391B	Clyde-Floyd complex, 1 to 4 percent slopes (where drained)
394B	Ostrander loam, 2 to 5 percent slopes
408B	Olin fine sandy loam, 2 to 5 percent slopes
428B	Ely silty clay loam, 2 to 5 percent slopes
462B	Downs silt loam, benches, 2 to 5 percent slopes
463B	Fayette silt loam, benches, 2 to 5 percent slopes
484	Lawson silt loam, 0 to 2 percent slopes
485	Spillville loam, 0 to 2 percent slopes
489	Ossian silt loam, 0 to 2 percent slopes (where drained)
585	Spillville-Coland complex, 0 to 2 percent slopes (where drained)
626	Hayfield loam, 0 to 2 percent slopes
760	Ansgar silt loam, 0 to 1 percent slopes
761B	Franklin silt loam, 1 to 4 percent slopes
771B	Waubeek silt loam, 2 to 5 percent slopes
775B	Billett sandy loam, 2 to 5 percent slopes
778	Sattre loam, 0 to 2 percent slopes

TABLE 5.--PRIME FARMLAND--Continued

Map symbol	Soil name
778B	Sattre loam, 2 to 5 percent slopes
814B	Rockton loam, 2 to 5 percent slopes
817C	Ripon silt loam, 2 to 7 percent slopes
930	Orion silt loam, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
933	Sawmill silty clay loam, 0 to 2 percent slopes (where drained)
976	Raddle silt loam, 0 to 2 percent slopes
976B	Raddle silt loam, 2 to 5 percent slopes
981B	Worthen silt loam, 2 to 5 percent slopes
1291	Atterberry silt loam, benches, 0 to 2 percent slopes
1291B	Atterberry silt loam, benches, 2 to 5 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
8B-------------- Judson	IIe	159	53	95	6.7	3.9	7.3	8.6
8C-------------- Judson	IIIe	154	52	92	6.5	3.8	7.1	8.3
11B------------- Colo-Ely	IIw	140	47	84	4.2	3.4	6.2	7.6
27B------------- Terril	IIe	158	48	95	6.3	3.9	7.0	8.3
27C------------- Terril	IIIe	153	47	92	6.1	3.8	6.7	8.0
41B------------- Sparta	IVs	77	26	46	3.2	1.9	3.2	4.9
41C------------- Sparta	VIs	72	24	43	3.0	1.8	3.0	4.7
42-------------- Granby	IVw	72	24	43	2.2	1.8	3.0	4.2
63B------------- Chelsea	IVs	68	23	41	2.9	1.7	3.3	3.3
63C------------- Chelsea	IVs	63	21	38	2.6	1.5	3.0	3.0
63F------------- Chelsea	VIIs	---	---	---	---	0.7	1.6	1.6
65C2------------ Lindley	IIIe	110	34	66	4.6	2.7	4.5	6.6
65E2------------ Lindley	VIe	---	---	---	3.5	2.1	3.4	5.5
65F2------------ Lindley	VIIe	---	---	---	---	1.8	3.0	2.8
83B------------- Kenyon	IIe	154	47	92	6.5	3.8	6.6	7.8
83C------------- Kenyon	IIIe	149	45	89	6.3	3.7	6.5	7.5
83C2------------ Kenyon	IIIe	145	44	87	6.1	3.6	6.3	7.3
84-------------- Clyde	IIw	140	43	84	4.2	3.4	5.5	6.6
109C------------ Backbone	IVs	47	14	28	2.0	1.2	3.0	3.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
109E------------ Backbone	VIs	---	---	---	---	0.5	2.2	3.0
110B------------ Lamont	IIIe	94	29	56	3.9	2.3	3.9	4.1
110C------------ Lamont	IIIe	89	27	53	3.7	2.2	3.6	3.8
110E------------ Lamont	VIe	---	---	---	2.6	1.5	2.5	3.0
118------------- Garwin	IIw	167	56	100	5.0	4.1	7.5	8.3
119B------------ Muscatine	IIe	167	56	100	6.7	4.1	7.6	9.1
120B------------ Tama	IIe	167	56	100	7.0	4.1	7.5	8.6
120C------------ Tama	IIIe	162	54	97	6.8	4.0	7.1	8.3
129B------------ Arenzville-Chaseburg	IIe	126	42	76	5.3	3.1	5.2	7.0
133------------- Colo	IIw	136	46	82	4.1	3.3	5.5	7.0
136------------- Ankeny	IIs	115	35	69	4.8	2.8	4.3	5.0
142------------- Chaseburg	IIw	135	45	81	5.7	3.3	5.5	7.5
143B------------ Brady	IIe	105	32	63	4.2	2.6	4.3	5.2
152------------- Marshan	IIw	126	38	76	3.8	3.1	5.2	5.8
153------------- Shandep	IIIw	96	29	58	2.9	2.4	3.9	5.6
159------------- Finchford	IVs	54	18	32	2.3	1.3	2.0	2.5
159C------------ Finchford	IVs	46	15	28	1.9	1.1	1.6	2.0
162B------------ Downs	IIe	158	53	95	6.6	3.9	7.1	8.3
162C------------ Downs	IIIe	153	51	92	6.4	3.8	6.8	8.1
162C2----------- Downs	IIIe	149	50	89	6.3	3.7	6.6	7.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
162D----------- Downs	IIIe	144	48	86	6.0	3.5	6.3	7.3
162D2---------- Downs	IIIe	140	47	84	5.9	3.4	6.1	7.1
163B----------- Fayette	IIe	149	50	89	6.3	3.7	6.6	7.8
163C----------- Fayette	IIIe	144	48	86	6.0	3.5	6.5	7.5
163C2---------- Fayette	IIIe	140	47	84	5.9	3.4	6.5	7.5
163D----------- Fayette	IIIe	135	45	81	5.7	3.3	6.0	7.0
163D2---------- Fayette	IIIe	131	44	79	5.5	3.2	5.8	6.6
163E----------- Fayette	IVe	118	40	71	5.0	2.9	5.0	5.8
163E2---------- Fayette	IVe	114	38	68	4.8	2.8	4.8	5.6
163F----------- Fayette	VIe	---	---	---	3.6	2.7	4.8	5.6
163F2---------- Fayette	VIe	---	---	---	3.1	2.6	4.5	5.0
163G----------- Fayette	VIIe	---	---	---	---	2.5	4.2	5.0
171B----------- Bassett	IIe	145	44	87	6.1	3.6	6.5	7.5
171C----------- Bassett	IIIe	140	43	84	5.9	3.4	6.1	7.1
171C2---------- Bassett	IIIe	136	41	82	5.7	3.3	6.0	6.6
171D----------- Bassett	IIIe	131	40	79	5.5	3.2	5.6	6.6
171D2---------- Bassett	IIIe	127	39	76	5.3	3.1	5.3	6.3
171E2---------- Bassett	IVe	110	34	66	4.6	2.7	4.5	5.1
174B----------- Bolan	IIe	121	37	73	4.8	3.0	5.2	6.1
174C----------- Bolan	IIIe	116	35	70	4.6	2.9	4.8	5.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
175B------------ Dickinson	IIIe	109	37	65	4.6	2.7	4.8	5.0
175C------------ Dickinson	IIIe	104	35	62	4.4	2.6	4.5	4.6
177------------- Saude	IIs	107	33	64	4.5	2.6	4.6	5.5
177B------------ Saude	IIe	104	32	62	4.4	2.6	4.5	5.3
178------------- Waukee	IIs	132	40	79	5.5	3.2	5.8	6.8
178B------------ Waukee	IIe	129	39	77	5.4	3.2	5.6	6.6
184B------------ Klinger	IIe	165	55	99	6.6	4.1	7.3	8.5
198B------------ Floyd	IIw	144	44	86	5.8	3.5	6.9	7.5
221------------- Palms	IIIw	115	39	69	3.5	2.8	4.7	6.5
226------------- Lawler	IIs	138	42	83	5.5	3.4	6.0	7.0
246------------- Curran	IIw	110	37	66	4.4	2.7	4.5	6.4
246B------------ Curran	IIe	107	36	64	4.3	2.6	4.4	6.4
284B------------ Flagler	IIIe	84	28	50	3.5	2.1	4.1	4.8
290------------- Dells	IIw	126	42	76	5.0	3.1	5.2	5.9
291B------------ Atterberry	IIe	150	50	90	6.0	3.7	6.2	7.9
293C------------ Chelsea-Lamont-Fayette	IIIe	98	33	59	4.1	2.4	4.2	4.8
293D------------ Chelsea-Lamont-Fayette	IVe	89	30	53	3.7	2.2	3.6	4.1
293F------------ Chelsea-Lamont-Fayette	VIIe	---	---	---	---	1.5	2.5	2.8
315------------- Perks-Chaseburg	Vw	---	---	---	---	0.5	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
320------------- Arenzville	IIw	135	45	81	5.7	3.3	5.5	6.9
350------------- Waukegan	IIs	145	49	87	6.1	3.6	5.9	5.6
350B------------ Waukegan	IIe	142	48	85	6.0	3.5	5.8	5.6
351------------- Atterberry	I	145	49	87	5.8	3.6	5.9	8.3
352B------------ Whittier	IIe	133	45	80	5.6	3.3	5.0	5.8
354------------- Aquolls	VIIw	---	---	---	---	0.5	---	---
377B------------ Dinsdale	IIe	160	54	96	6.7	3.9	7.1	8.3
377C------------ Dinsdale	IIIe	155	52	93	6.5	3.8	6.8	8.0
377C2----------- Dinsdale	IIIe	151	51	91	6.3	3.7	6.6	7.6
381B------------ Klinger-Maxfield	IIw	161	54	97	4.8	4.0	7.0	8.4
382------------- Maxfield	IIw	160	54	96	4.8	3.9	6.6	8.3
391B------------ Clyde-Floyd	IIw	135	41	81	4.1	3.3	6.1	7.0
394B------------ Ostrander	IIe	154	47	92	6.5	3.8	---	6.7
394C------------ Ostrander	IIIe	149	45	89	6.3	3.7	---	6.3
408B------------ Olin	IIe	133	45	80	5.6	3.3	5.8	6.8
408C------------ Olin	IIIe	128	43	77	5.4	3.1	5.5	6.5
412C------------ Emeline	IVs	61	20	37	2.6	1.5	2.3	2.5
412E------------ Emeline	VIIs	---	---	---	---	0.9	1.6	2.0
428B------------ Ely	IIe	159	53	95	6.4	3.9	7.5	8.8
462B------------ Downs	IIe	158	53	95	6.6	3.9	7.1	8.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
462C------------ Downs	IIIe	153	51	92	6.4	3.8	6.8	8.1
463B------------ Fayette	IIe	149	50	89	6.3	3.7	6.6	7.8
463C------------ Fayette	IIIe	144	48	86	6.0	3.5	6.5	7.5
478G**---------- Nordness-Rock outcrop	VIIs	---	---	---	---	0.5	---	---
480C------------ Orwood	IIIe	147	49	88	6.2	3.6	6.0	7.0
480C2----------- Orwood	IIIe	143	48	86	6.0	3.5	5.6	6.6
480D------------ Orwood	IIIe	138	46	83	5.8	3.4	5.3	6.1
480D2----------- Orwood	IIIe	134	45	80	5.6	3.3	5.1	6.0
480E------------ Orwood	IVe	121	41	73	5.1	3.0	4.5	5.1
480E2----------- Orwood	IVe	117	39	70	4.9	2.9	4.1	4.8
480F2----------- Orwood	VIe	---	---	---	2.8	2.6	3.6	4.5
484------------- Lawson	IIw	157	53	94	6.3	3.9	6.4	8.0
485------------- Spillville	IIw	156	48	94	6.2	3.8	7.3	8.6
489------------- Ossian	IIw	140	47	84	4.2	3.4	6.6	7.6
499D------------ Nordness	VIs	---	---	---	1.4	0.8	1.2	2.0
499F------------ Nordness	VIIs	---	---	---	---	0.2	0.8	0.8
539------------- Perks	Vw	---	---	---	---	1.5	2.5	4.3
585------------- Spillville-Coland	IIw	140	43	84	4.2	3.4	6.8	8.3
626------------- Hayfield	IIs	120	37	72	3.6	3.0	4.9	5.3
673D2----------- Timula	IIIe	128	43	77	5.4	3.1	5.2	6.4

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
673E2----------- Timula	IVe	111	37	67	4.7	2.7	4.5	5.6
703D------------ Dubuque	IVe	81	27	49	3.4	2.0	3.3	5.5
703F------------ Dubuque	VIIe	---	---	---	---	1.3	3.9	4.0
760------------- Ansgar	IIw	151	51	91	4.5	3.7	5.5	6.1
761B------------ Franklin	IIe	151	51	91	6.0	3.7	7.0	8.0
763D2----------- Exette	IIIe	126	42	76	5.3	3.1	5.5	6.5
763E2----------- Exette	IVe	109	37	65	4.6	2.7	4.5	5.3
763F2----------- Exette	VIe	---	---	---	3.2	2.4	2.9	4.6
771B------------ Waubeek	IIe	151	51	91	6.3	3.7	6.8	7.8
771C------------ Waubeek	IIIe	146	49	88	6.1	3.6	6.5	7.5
771C2----------- Waubeek	IIIe	142	48	85	6.0	3.5	6.3	7.3
771D------------ Waubeek	IIIe	137	46	82	5.8	3.4	6.0	7.0
771D2----------- Waubeek	IIIe	133	45	80	5.6	3.3	5.6	6.6
775B------------ Billett	IIIs	99	33	59	4.2	2.4	4.1	4.0
775D------------ Billett	IIIs	85	28	51	3.6	2.1	3.5	5.0
775E------------ Billett	IVs	---	---	---	2.9	1.7	2.8	3.8
778------------- Sattre	IIs	123	38	74	5.2	3.0	5.5	6.5
778B------------ Sattre	IIe	120	37	72	5.0	3.0	5.3	6.3
809B------------ Bertram	IVs	57	17	34	2.4	1.4	3.6	4.5
809C------------ Bertram	IVs	52	16	31	2.2	1.3	3.0	3.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
814B------------ Rockton	IIe	117	36	70	4.9	2.9	4.8	5.9
814C------------ Rockton	IIIe	112	34	67	4.7	2.8	4.6	5.8
817C------------ Ripon	IIe	121	41	73	5.1	3.0	5.0	6.8
914C------------ Winneshiek	IIIe	103	31	62	4.3	2.5	4.2	5.8
914E------------ Winneshiek	VIe	---	---	---	3.2	1.9	3.2	4.9
930------------- Orion	IIw	128	43	77	5.1	3.1	5.2	6.9
933------------- Sawmill	IIw	136	46	82	4.1	3.3	5.6	6.0
976------------- Raddle	I	162	54	97	6.8	4.0	6.6	8.7
976B------------ Raddle	IIe	159	53	95	6.7	3.9	6.5	8.6
981B------------ Worthen	IIe	159	53	95	6.7	3.9	6.5	8.7
1291------------ Atterberry	I	153	51	92	6.1	3.8	6.3	8.0
1291B----------- Atterberry	IIe	150	50	90	6.0	3.7	6.2	7.9
5010**, 5030**. Pits								
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 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)

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Produc-tivity class*	
41B, 41C-------- Sparta	6A	Slight	Slight	Slight	Slight	Jack pine-----------	57	6	Red pine, eastern white pine, jack pine.
						Northern red oak----	47	2	
						Red pine------------	---	---	
42-------------- Granby	2W	Slight	Severe	Severe	Severe	Silver maple--------	82	2	
						Red maple-----------	68	3	
						American basswood---	---	---	
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern cottonwood--	---	---	
63B, 63C-------- Chelsea	5S	Slight	Slight	Moderate	Slight	White oak-----------	70	5	Eastern white pine, red pine, jack pine.
						Red pine------------	72	9	
						Eastern white pine--	83	13	
						Jack pine-----------	70	7	
						Quaking aspen-------	72	6	
						Northern red oak----	70	5	
63F------------- Chelsea	5R	Moderate	Severe	Moderate	Slight	White oak-----------	70	5	Eastern white pine, red pine, jack pine.
						Red pine------------	72	9	
						Eastern white pine--	83	13	
						Jack pine-----------	70	7	
						Quaking aspen-------	72	6	
						Northern red oak----	70	5	
65C2, 65E2------ Lindley	3A	Slight	Slight	Slight	Slight	White oak-----------	60	3	White oak, green ash, black oak, northern red oak.
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Post oak------------	---	---	
65F2------------ Lindley	3R	Moderate	Moderate	Slight	Slight	White oak-----------	60	3	White oak, green ash, black oak, northern red oak.
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Post oak------------	---	---	
109C, 109E------ Backbone	3D	Slight	Slight	Slight	Moderate	Northern red oak----	55	3	Eastern white pine, red pine, black walnut, sugar maple.
						White oak-----------	55	3	
110B, 110C, 110E----------- Lamont	3A	Slight	Slight	Slight	Slight	Northern red oak----	55	3	Eastern white pine.
						White oak-----------	55	3	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Produc-tivity class*	
129B**:									
Arenzville	4A	Slight	Slight	Slight	Slight	Northern red oak	65	4	Red pine, eastern white pine, white spruce, northern red oak, black walnut.
						Bur oak	---	---	
						Silver maple	---	---	
Chaseburg	4A	Slight	Slight	Slight	Slight	Northern red oak	65	4	Red pine, eastern white pine, white spruce, sugar maple, black walnut, northern red oak.
						Sugar maple	---	---	
						American basswood	---	---	
142 Chaseburg	4W	Slight	Moderate	Slight	Slight	Northern red oak	65	4	Red pine, eastern white pine, white spruce, sugar maple, black walnut, northern red oak.
						Sugar maple	---	---	
						American basswood	---	---	
143B Brady	3W	Slight	Moderate	Slight	Slight	Red maple	61	3	Eastern white pine, white spruce.
						White ash	---	---	
						Quaking aspen	---	---	
						Silver maple	---	---	
						Bitternut hickory	---	---	
						Swamp white oak	---	---	
						American basswood	61	4	
162B, 162C, 162C2, 162D, 162D2 Downs	4A	Slight	Slight	Slight	Slight	White oak	65	4	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	65	4	
163B, 163C, 163C2, 163D, 163D2 Fayette	4A	Slight	Slight	Slight	Slight	White oak	65	4	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	65	4	
163E, 163E2, 163F, 163F2, 163G Fayette	4R	Moderate	Moderate	Slight	Slight	White oak	65	4	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	65	4	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
171B, 171C, 171C2, 171D, 171D2 Bassett	3A	Slight	Slight	Slight	Slight	White oak	55	3	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	55	3	
171E2 Bassett	3R	Moderate	Moderate	Slight	Slight	White oak	55	3	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	55	3	
221 Palms	2W	Slight	Severe	Severe	Severe	Red maple	55	2	
						Silver maple	80	2	
						White ash	---	---	
						Quaking aspen	---	---	
						Northern whitecedar	---	---	
						Tamarack	---	---	
						Black ash	---	---	
246, 246B Curran	2A	Slight	Slight	Slight	Slight	Silver maple	70	2	White spruce, white ash, red maple.
						Red maple	55	2	
						White ash	---	---	
						Quaking aspen	---	---	
290 Dells	2A	Slight	Slight	Slight	Slight	Silver maple	80	2	Silver maple, white ash, white spruce.
						Northern red oak	---	---	
						White ash	---	---	
291B Atterberry	4A	Slight	Slight	Slight	Slight	Northern red oak	65	4	Eastern white pine, red pine, Norway spruce, green ash, silver maple.
						White oak	---	---	
						Silver maple	---	---	
						White ash	---	---	
						Green ash	---	---	
293C**, 293D**:									
Chelsea	5S	Slight	Slight	Moderate	Slight	White oak	70	5	Eastern white pine, red pine, jack pine.
						Red pine	72	9	
						Eastern white pine	83	13	
						Jack pine	70	7	
						Quaking aspen	72	6	
						Northern red oak	70	5	
Lamont	3A	Slight	Slight	Slight	Slight	Northern red oak	55	3	Eastern white pine.
						White oak	55	3	
Fayette	4A	Slight	Slight	Slight	Slight	White oak	65	4	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	65	4	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Produc-tivity class*	
293F**:									
Chelsea	5R	Moderate	Severe	Moderate	Slight	White oak	70	5	Eastern white pine, red pine, jack pine.
						Red pine	72	9	
						Eastern white pine	83	13	
						Jack pine	70	7	
						Quaking aspen	72	6	
						Northern red oak	70	5	
Lamont	3R	Moderate	Moderate	Slight	Slight	Northern red oak	55	3	Eastern white pine.
						White oak	55	3	
Fayette	4R	Moderate	Moderate	Slight	Slight	White oak	65	4	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	65	4	
315**:									
Perks	3S	Slight	Slight	Moderate	Slight	White oak	55	3	Eastern white pine.
Chaseburg	4W	Slight	Moderate	Slight	Slight	Northern red oak	65	4	Red pine, eastern white pine, white spruce, sugar maple, black walnut, northern red oak.
						Sugar maple	---	---	
						American basswood	---	---	
320 Arenzville	4A	Slight	Slight	Slight	Slight	Northern red oak	65	4	Red pine, eastern white pine, white spruce, northern red oak, black walnut.
						Bur oak	---	---	
						Silver maple	---	---	
351 Atterberry	4A	Slight	Slight	Slight	Slight	White oak	70	4	Eastern white pine, red pine, Scotch pine, eastern redcedar.
						Northern red oak	70	4	
						Green ash	---	---	
						Bur oak	---	---	
352B Whittier	4A	Slight	Slight	Slight	Slight	White oak	75	4	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak	80	4	
412C, 412E Emeline	2D	Slight	Severe	Severe	Severe	Black oak	50	2	Eastern redcedar, eastern white pine, red pine, jack pine, bur oak.
						Bur oak	50	2	
						Eastern redcedar	50	4	
						Shagbark hickory	50	---	
						Northern red oak	50	2	
						American elm	50	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
462B, 462C------ Downs	4A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	4 4	Eastern white pine, red pine, black walnut, sugar maple.
463B, 463C------ Fayette	4A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	4 4	Eastern white pine, red pine, black walnut, sugar maple.
478G**:									
Nordness-------	2R	Moderate	Moderate	Severe	Severe	Northern red oak---- White oak-----------	45 45	2 2	
Rock outcrop.									
480C, 480C2, 480D, 480D2---- Orwood	4A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	4 4	Eastern white pine, red pine, black walnut, sugar maple.
480E, 480E2, 480F2---------- Orwood	4R	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	65 65	4 4	Eastern white pine, red pine, black walnut, sugar maple.
484------------- Lawson	2A	Slight	Slight	Slight	Slight	Silver maple-------- White ash----------- Red maple-----------	70 --- ---	2 --- ---	White spruce, silver maple, white ash.
499D------------ Nordness	2D	Slight	Slight	Severe	Severe	Northern red oak---- White oak-----------	45 45	2 2	
499F------------ Nordness	2R	Moderate	Moderate	Severe	Severe	Northern red oak---- White oak-----------	45 45	2 2	
539------------- Perks	3S	Slight	Slight	Moderate	Slight	White oak-----------	55	3	Eastern white pine.
626------------- Hayfield	4A	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Eastern white pine--	65 65 60	4 4 8	Northern red oak, white oak, silver maple, eastern white pine, black walnut, red pine, white spruce, white ash.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	Produc- tivity class*	
673D2----------- Timula	5A	Slight	Slight	Slight	Slight	White oak-----------	70	5	Eastern white pine, red pine, Scotch pine.
						Northern red oak----	---	---	
						Green ash-----------	---	---	
						Bur oak-------------	---	---	
673E2----------- Timula	5R	Moderate	Moderate	Slight	Slight	White oak-----------	70	5	Eastern white pine, red pine, Scotch pine.
						Northern red oak----	---	---	
						Green ash-----------	---	---	
						Bur oak-------------	---	---	
703D------------ Dubuque	4A	Slight	Slight	Slight	Slight	Northern red oak----	65	4	Eastern white pine, red pine, black walnut.
						White oak-----------	65	4	
703F------------ Dubuque	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	65	4	Eastern white pine, red pine, black walnut.
						White oak-----------	65	4	
761B------------ Franklin	4A	Slight	Slight	Slight	Slight	White oak-----------	65	4	Eastern white pine, white oak, black walnut, sugar maple, northern red oak.
						Northern red oak----	65	4	
763D2----------- Exette	6A	Slight	Slight	Slight	Slight	White oak-----------	80	6	Eastern white pine, red pine, white oak, northern red oak, green ash, black walnut.
						Northern red oak----	80	6	
						Black walnut--------	---	---	
						Green ash-----------	---	---	
						Sugar maple---------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
763E2, 763F2---- Exette	6R	Moderate	Moderate	Slight	Slight	White oak-----------	80	6	Eastern white pine, red pine, white oak, northern red oak, green ash, black walnut.
						Northern red oak----	80	6	
						Black walnut--------	---	---	
						Green ash-----------	---	---	
						Sugar maple---------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
771B, 771C, 771C2, 771D, 771D2---------- Waubeek	4A	Slight	Slight	Slight	Slight	White oak-----------	65	4	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	65	4	
775B, 775D------ Billett	4A	Slight	Slight	Slight	Slight	Northern red oak----	60	4	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Northern pin oak----	---	---	
						Shagbark hickory----	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns: Erosion hazard	Management concerns: Equip- ment limita- tion	Management concerns: Seedling mortal- ity	Management concerns: Wind- throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Produc- tivity class*	Trees to plant
775E------------ Billett	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	60	4	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Northern pin oak----	---	---	
						Shagbark hickory----	---	---	
778, 778B------- Sattre	4A	Slight	Slight	Slight	Slight	Northern red oak----	65	4	Eastern white pine, red pine, black walnut, sugar maple.
						White oak-----------	65	4	
914C------------ Winneshiek	4D	Slight	Slight	Slight	Moderate	Northern red oak----	65	4	Eastern white pine, red pine, black walnut.
						White oak-----------	65	4	
914E------------ Winneshiek	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	65	4	Eastern white pine, red pine, black walnut.
						White oak-----------	65	4	
930------------- Orion	2W	Slight	Moderate	Slight	Slight	Silver maple--------	80	2	White spruce, silver maple, white ash, eastern cottonwood.
						Red maple-----------	---	---	
						White ash-----------	---	---	
1291, 1291B----- Atterberry	4A	Slight	Slight	Slight	Slight	Northern red oak----	65	4	Eastern white pine, red pine, Norway spruce, green ash, silver maple.
						White oak-----------	---	---	
						Silver maple--------	---	---	
						White ash-----------	---	---	
						Green ash-----------	---	---	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** 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 height, in feet, of-- <8	8-15	16-25	26-35	>35
8B, 8C----------- Judson	---	Siberian peashrub, Siberian peashrub, lilac.	Bur oak, hackberry, eastern redcedar, blue spruce, Russian olive.	Ponderosa pine, honeylocust, green ash.	---
11B*:					
Colo-----------	---	Redosier dogwood, American plum.	White fir, white spruce, hackberry, Amur maple, tall purple willow.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Ely-------------	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
27B, 27C---------- Terril	---	Gray dogwood, Siberian peashrub, redosier dogwood, lilac.	Honeylocust, Russian olive, Amur maple, blue spruce, northern whitecedar, eastern redcedar.	Eastern white pine, green ash.	---
41B, 41C---------- Sparta	Manyflower cotoneaster.	Siberian peashrub, Amur maple, lilac, eastern redcedar, American cranberrybush, gray dogwood, silky dogwood.	Norway spruce-----	Red pine, eastern white pine, jack pine.	---
42--------------- Granby	---	Silky dogwood, Amur privet, American cranberrybush, lilac, nannyberry viburnum.	Northern whitecedar, Manchurian crabapple.	Eastern white pine, Norway spruce, white spruce, green ash.	Imperial Carolina poplar.
63B, 63C, 63F----- Chelsea	Siberian peashrub, lilac.	Eastern redcedar	Red pine, jack pine, Austrian pine.	Eastern white pine	---
65C2, 65E2, 65F2-- Lindley	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
83B, 83C, 83C2---- Kenyon	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern whitecedar, hackberry, blue spruce, eastern redcedar, Russian olive, Amur maple.	Eastern white pine, green ash.	---
84---------------- Clyde	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
109C, 109E-------- Backbone	Lilac-------------	Eastern redcedar, Siberian peashrub, silver buffaloberry.	Russian olive, eastern white pine, Manchurian crabapple, green ash, hackberry.	Honeylocust, Siberian elm.	---
110B, 110C, 110E-- Lamont	Lilac-------------	Eastern redcedar, Russian olive, Siberian peashrub.	Eastern white pine, Norway spruce, hackberry, Amur maple, red pine, honeylocust, green ash.	---	---
118--------------- Garwin	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
119B-------------- Muscatine	---	Lilac, redosier dogwood.	Blue spruce, northern whitecedar, white spruce, Amur maple.	Austrian pine, eastern white pine, hackberry, green ash.	Silver maple.
120B, 120C-------- Tama	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern whitecedar, eastern redcedar, Amur maple, blue spruce, hackberry, Russian olive.	Green ash, eastern white pine.	---
129B*: Arenzville-------	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple.	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 height, in feet, of--				
	<8	8-15	16-25	26-35	>35
129B*: Chaseburg	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, gray dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
133 Colo	---	Redosier dogwood, American plum.	White fir, white spruce, hackberry, Amur maple, tall purple willow.	Green ash, golden willow.	Silver maple, eastern cottonwood.
136 Ankeny	Lilac	Eastern redcedar, Siberian peashrub, Russian olive.	Hackberry, Norway spruce, red pine, eastern white pine, honeylocust, Amur maple, green ash.	---	---
142 Chaseburg	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, gray dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
143B Brady	---	Silky dogwood, lilac, nannyberry viburnum, Amur maple, American cranberrybush.	Northern whitecedar.	White spruce, Norway spruce, eastern white pine, red pine, green ash.	Imperial Carolina poplar.
152 Marshan	---	Common ninebark, redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, northern whitecedar.	Balsam fir, white spruce.	Green ash, white ash, red maple, silver maple.	---
153 Shandep	---	Redosier dogwood	Tall purple willow, black ash.	Black willow, white willow, golden willow.	---
159, 159C Finchford	Siberian peashrub, lilac.	Eastern redcedar, sargent crabapple.	Siberian elm, red pine, jack pine, Austrian pine, green ash, Russian olive.	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 height, in feet, of--				
	<8	8-15	16-25	26-35	>35
162B, 162C, 162C2, 162D, 162D2------ Downs	---	Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, blue spruce, Russian olive, eastern redcedar, Amur maple.	Eastern white pine, green ash.	---
163B, 163C, 163C2, 163D, 163D2, 163E, 163E2, 163F, 163F2, 163G------------- Fayette	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, Russian olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
171B, 171C, 171C2, 171D, 171D2, 171E2------------ Bassett	---	Redosier dogwood, gray dogwood, Siberian peashrub, lilac.	Russian olive, eastern redcedar, northern whitecedar, blue spruce, Amur maple, hackberry.	Green ash, eastern white pine.	---
174B, 174C-------- Bolan	Lilac, Russian olive, Siberian peashrub.	Eastern redcedar, hackberry, Manchurian crabapple.	Honeylocust, green ash, eastern white pine, bur oak.	---	---
175B, 175C-------- Dickinson	Lilac-------------	Eastern redcedar, Russian olive, Siberian peashrub.	Eastern white pine, green ash, Norway spruce, honeylocust, red pine, Amur maple, hackberry.	---	---
177, 177B--------- Saude	Lilac, Siberian peashrub.	Manchurian crabapple, hackberry, eastern redcedar.	Eastern white pine, bur oak, jack pine, green ash, honeylocust, Russian olive.	---	---
178, 178B--------- Waukee	Lilac, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, hackberry.	Honeylocust, Russian olive, green ash, bur oak, jack pine, eastern white pine.	---	---
184B-------------- Klinger	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	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 height, in feet, of-- <8	8-15	16-25	26-35	>35
198B Floyd	---	Redosier dogwood, lilac.	Blue spruce, Amur maple, northern whitecedar, white spruce.	Austrian pine, hackberry, green ash, eastern white pine.	Silver maple.
221 Palms	Vanhoutte spirea	Silky dogwood, common ninebark, nannyberry viburnum, American cranberrybush.	Northern whitecedar, Manchurian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
226 Lawler	---	Lilac, redosier dogwood.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Eastern white pine, hackberry, Austrian pine, green ash.	Silver maple.
246, 246B. Curran					
284B Flagler	Lilac, Siberian peashrub.	Manchurian crabapple, hackberry, eastern redcedar.	Honeylocust, eastern white pine, jack pine, green ash, Russian olive, bur oak.	---	---
290 Dells	---	Northern whitecedar, lilac, nannyberry viburnum, silky dogwood, American cranberrybush, redosier dogwood.	White spruce	Eastern white pine, red pine, silver maple, white ash, red maple.	---
291B Atterberry	---	Silky dogwood, redosier dogwood, lilac.	White spruce, blue spruce, northern whitecedar, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
293C*, 293D*, 293F*:					
Chelsea	Siberian peashrub, lilac.	Eastern redcedar	Red pine, jack pine, Austrian pine.	Eastern white pine	---
Lamont	Lilac	Eastern redcedar, Russian olive, Siberian peashrub.	Eastern white pine, Norway spruce, hackberry, Amur maple, red pine, honeylocust, green ash.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
293C*, 293D*, 293F*:					
Fayette	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, Russian olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
315*:					
Perks.					
Chaseburg	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, gray dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple, silver maple.	---
320 Arenzville	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce	Eastern white pine, red pine, white ash, red maple.	Silver maple.
350, 350B Waukegan	Siberian peashrub, lilac, Tatarian honeysuckle.	Eastern redcedar, hackberry, Manchurian crabapple.	Jack pine, bur oak, Russian olive, honeylocust, green ash, eastern white pine.	---	---
351 Atterberry	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
352B Whittier	Siberian peashrub	Lilac, Amur honeysuckle, autumn olive, Washington hawthorn, radiant crabapple, eastern redcedar.	Eastern white pine, jack pine, red pine, Austrian pine.	---	---
354. Aquolls					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
377B, 377C, 377C2-Dinsdale	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, blue spruce, Amur maple, eastern redcedar, Russian olive.	Eastern white pine, green ash.	---
381B*:					
Klinger	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
Maxfield	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
382-Maxfield	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
391B*:					
Clyde	---	Redosier dogwood, American plum.	Hackberry, Amur maple, northern whitecedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
Floyd	---	Redosier dogwood, lilac.	Blue spruce, Amur maple, northern whitecedar, white spruce.	Austrian pine, hackberry, green ash, eastern white pine.	Silver maple.
394B, 394C-Ostrander	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Hackberry, Russian olive, Amur maple, blue spruce, eastern redcedar, northern whitecedar.	Eastern white pine, green ash.	---
408B, 408C-Olin	Lilac	Russian olive, eastern redcedar, cotoneaster, Siberian peashrub.	Red pine, green ash, Norway spruce, eastern white pine, Amur maple, hackberry, honeylocust.	---	---
412C, 412E. Emeline					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
428B-------------- Ely	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
462B, 462C-------- Downs	---	Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, blue spruce, Russian olive, eastern redcedar, Amur maple.	Eastern white pine, green ash.	---
463B, 463C-------- Fayette	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, Russian olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
478G*: Nordness.					
Rock outcrop.					
480C, 480C2, 480D, 480D2, 480E, 480E2, 480F2----- Orwood	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Eastern redcedar, Russian olive, northern whitecedar, blue spruce, Amur maple, hackberry.	Eastern white pine, green ash.	---
484--------------- Lawson	---	Common ninebark, northern whitecedar, nannyberry viburnum, redosier dogwood, American cranberrybush, lilac, silky dogwood.	White spruce------	Eastern white pine, white ash, red maple, silver maple.	---
485--------------- Spillville	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
489--------------- Ossian	---	Redosier dogwood, American plum.	Hackberry, tall purple willow, white spruce, northern whitecedar, Amur maple.	Golden willow, green ash.	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 height, in feet, of-- <8	8-15	16-25	26-35	>35
499D, 499F. Nordness					
539. Perks					
585*: Spillville	---	Redosier dogwood, lilac.	Northern whitecedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
Coland	---	Redosier dogwood, cotoneaster, American plum.	White spruce, hackberry, northern whitecedar, tall purple willow, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
626 Hayfield	---	Redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, lilac, northern whitecedar.	White spruce	Silver maple, red maple, white ash, red pine, eastern white pine.	---
673D2, 673E2 Timula	American plum	Eastern redcedar, hackberry, Siberian peashrub, Tatarian honeysuckle.	Russian olive, green ash, honeylocust.	Siberian elm	---
703D, 703F Dubuque	Lilac	Eastern redcedar, Siberian peashrub.	Green ash, Manchurian crabapple, jack pine, hackberry, Russian olive, eastern white pine.	Honeylocust, Siberian elm.	---
760 Ansgar	---	Redosier dogwood, American plum, cotoneaster.	Amur maple, white spruce, northern whitecedar, hackberry, tall purple willow.	Green ash, golden willow.	Eastern cottonwood, silver maple.
761B Franklin	---	Redosier dogwood, lilac.	White spruce, northern whitecedar, blue spruce, Amur maple.	Austrian pine, eastern white pine, green ash, hackberry.	Silver maple.
763D2, 763E2, 763F2 Exette	---	Redosier dogwood, lilac, gray dogwood, Siberian peashrub.	Eastern redcedar, Russian olive, blue spruce, Amur maple, hackberry.	Green ash, 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 height, in feet, of-- <8	8-15	16-25	26-35	>35
771B, 771C, 771C2, 771D, 771D2------ Waubeek	---	Redosier dogwood, lilac, gray dogwood, Siberian peashrub.	Eastern redcedar, northern whitecedar, blue spruce, Amur maple, hackberry, Russian olive.	Eastern white pine, green ash.	---
775B, 775D, 775E-- Billett	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, eastern redcedar.	Norway spruce-----	Jack pine, red pine, eastern white pine.	---
778, 778B--------- Sattre	Lilac, Siberian peashrub.	Hackberry, eastern redcedar, Manchurian crabapple.	Eastern white pine, bur oak, Russian olive, green ash, jack pine, honeylocust.	---	---
809B, 809C-------- Bertram	Lilac-------------	Eastern redcedar, Siberian peashrub.	Green ash, eastern white pine, Russian olive, hackberry, Manchurian crabapple.	Honeylocust, Siberian elm.	---
814B, 814C-------- Rockton	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn olive, Amur honeysuckle, lilac, silky dogwood.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
817C-------------- Ripon	Manyflower cotoneaster.	Eastern redcedar, lilac, gray dogwood, silky dogwood, Amur maple, American cranberrybush, Siberian peashrub.	Norway spruce-----	Eastern white pine, jack pine, red pine.	---
914C, 914E-------- Winneshiek	Lilac-------------	Eastern redcedar, Siberian peashrub.	Russian olive, eastern white pine, green ash, Manchurian crabapple, jack pine, hackberry.	Honeylocust, Siberian elm.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
930------------------- Orion	---	Common ninebark, nannyberry viburnum, northern whitecedar, lilac, American cranberrybush, silky dogwood, redosier dogwood.	White spruce------	Eastern white pine, white ash, red maple, silver maple.	---
933------------------- Sawmill	---	Redosier dogwood, American plum.	Northern whitecedar, white spruce, tall purple willow, hackberry, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
976, 976B--------- Raddle	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
981B-------------- Worthen	---	Siberian peashrub, redosier dogwood, gray dogwood, lilac.	Eastern redcedar, northern whitecedar, Amur maple, blue spruce, hackberry, Russian olive.	Green ash, eastern white pine.	---
1291, 1291B------- Atterberry	---	Silky dogwood, redosier dogwood, lilac.	White spruce, blue spruce, northern whitecedar, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
5010*, 5030*. Pits					
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
8B-------------------- Judson	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
8C-------------------- Judson	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
11B*:					
Colo-----------------	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Ely------------------	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
27B------------------- Terril	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
27C------------------- Terril	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
41B------------------- Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
41C------------------- Sparta	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty.
42-------------------- Granby	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
63B------------------- Chelsea	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
63C------------------- Chelsea	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty.
63F------------------- Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
65C2------------------ Lindley	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight----------	Slight.
65E2------------------ Lindley	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
65F2------------------ Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
83B------------------- Kenyon	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
83C, 83C2: Kenyon	Slight	Slight	Severe: slope.	Slight	Slight.
84: Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
109C: Backbone	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Moderate: thin layer, area reclaim.
109E: Backbone	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope, thin layer, area reclaim.
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.
119B: Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
120B: Tama	Slight	Slight	Moderate: slope.	Slight	Slight.
120C: Tama	Slight	Slight	Severe: slope.	Slight	Slight.
129B*:					
Arenzville	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight	Moderate: flooding.
Chaseburg	Severe: flooding.	Slight	Moderate: slope.	Slight	Moderate: flooding.
133: Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
136: Ankeny	Slight	Slight	Slight	Slight	Slight.
142: Chaseburg	Severe: flooding.	Moderate: flooding.	Slight	Moderate: flooding.	Severe: flooding.
143B: Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
152: Marshan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

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
153 Shandep	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
159, 159C Finchford	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
162B Downs	Slight	Slight	Moderate: slope.	Slight	Slight.
162C, 162C2 Downs	Slight	Slight	Severe: slope.	Slight	Slight.
162D, 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 Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
163E, 163E2, 163F, 163F2 Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
163G Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
171B Bassett	Slight	Slight	Moderate: slope.	Slight	Slight.
171C, 171C2 Bassett	Slight	Slight	Severe: slope.	Slight	Slight.
171D, 171D2 Bassett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
171E2 Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
174B Bolan	Slight	Slight	Moderate: slope.	Slight	Slight.
174C Bolan	Slight	Slight	Severe: slope.	Slight	Slight.
175B Dickinson	Slight	Slight	Moderate: slope.	Slight	Slight.
175C Dickinson	Slight	Slight	Severe: slope.	Slight	Slight.
177 Saude	Slight	Slight	Slight	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
177B------------------ Saude	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
178------------------- Waukee	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
178B------------------ Waukee	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
184B------------------ Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
198B------------------ Floyd	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
221------------------- Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
226------------------- Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
246, 246B------------- Curran	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
284B------------------ Flagler	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
290------------------- Dells	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
291B------------------ Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
293C*:					
Chelsea--------------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Lamont---------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Fayette--------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
293D*:					
Chelsea--------------	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, droughty.
Lamont---------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
Fayette--------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	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
293F*:					
Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
Lamont	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
315*:					
Perks	Severe: flooding.	Moderate: flooding.	Slight	Moderate: flooding.	Severe: droughty, flooding.
Chaseburg	Severe: flooding.	Moderate: flooding.	Slight	Moderate: flooding.	Severe: flooding.
320 Arenzville	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
350 Waukegan	Slight	Slight	Slight	Slight	Slight.
350B Waukegan	Slight	Slight	Moderate: slope.	Slight	Slight.
351 Atterberry	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
352B Whittier	Slight	Slight	Moderate: slope.	Slight	Slight.
354. Aquolls					
377B Dinsdale	Slight	Slight	Moderate: slope.	Slight	Slight.
377C, 377C2 Dinsdale	Slight	Slight	Severe: slope.	Slight	Slight.
381B*:					
Klinger	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
382 Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
391B*:					
Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Floyd	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	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
394B----- Ostrander	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
394C----- Ostrander	Slight-----	Slight-----	Severe: slope.	Slight-----	Slight.
408B----- Olin	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
408C----- Olin	Slight-----	Slight-----	Severe: slope.	Slight-----	Slight.
412C----- Emeline	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Slight-----	Severe: thin layer, area reclaim.
412E----- Emeline	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Slight-----	Severe: thin layer, area reclaim.
428B----- Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight-----	Slight.
462B----- Downs	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
462C----- Downs	Slight-----	Slight-----	Severe: slope.	Slight-----	Slight.
463B----- Fayette	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
463C----- Fayette	Slight-----	Slight-----	Severe: slope.	Slight-----	Slight.
478G*:					
Nordness-----	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.	Severe: slope, thin layer, area reclaim.
Rock outcrop.					
480C, 480C2----- Orwood	Slight-----	Slight-----	Severe: slope.	Slight-----	Slight.
480D, 480D2----- Orwood	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
480E, 480E2, 480F2----- Orwood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
484----- Lawson	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
485----- Spillville	Severe: flooding.	Slight-----	Moderate: flooding.	Slight-----	Moderate: flooding.

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
489 Ossian	Severe: wetness, flooding.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
499D Nordness	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.	Severe: thin layer, area reclaim.
499F Nordness	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.	Severe: slope, thin layer, area reclaim.
539 Perks	Severe: flooding.	Moderate: flooding.	Slight	Moderate: flooding.	Severe: droughty, flooding.
585*:					
Spillville	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Coland	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
626 Hayfield	Slight	Slight	Slight	Slight	Slight.
673D2 Timula	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
673E2 Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
703D Dubuque	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer, area reclaim.
703F Dubuque	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
760 Ansgar	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
761B Franklin	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
763D2 Exette	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
763E2, 763F2 Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
771B Waubeek	Slight	Slight	Moderate: slope.	Slight	Slight.
771C, 771C2 Waubeek	Slight	Slight	Severe: 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
771D, 771D2 Waubeek	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
775B Billett	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
775D Billett	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
775E Billett	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
778 Sattre	Slight	Slight	Slight	Slight	Slight.
778B Sattre	Slight	Slight	Moderate: slope.	Slight	Slight.
809B Bertram	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight	Moderate: thin layer, area reclaim.
809C Bertram	Slight	Slight	Severe: slope.	Slight	Moderate: thin layer, area reclaim.
814B Rockton	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight	Moderate: thin layer, area reclaim.
814C Rockton	Slight	Slight	Severe: slope.	Slight	Moderate: thin layer, area reclaim.
817C Ripon	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight	Moderate: thin layer, area reclaim.
914C Winneshiek	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, thin layer, area reclaim.	Slight	Moderate: thin layer, area reclaim.
914E Winneshiek	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
930 Orion	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
933 Sawmill	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
976 Raddle	Slight	Slight	Slight	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
976B: Raddle	Slight	Slight	Moderate: slope.	Slight	Slight.
981B: Worthen	Slight	Slight	Moderate: slope.	Slight	Slight.
1291, 1291B: Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
5010*, 5030*. Pits					
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
8B-----Judson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
8C-----Judson	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
11B*:										
Colo-----	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
Ely-----	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
27B-----Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
27C-----Terril	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
41B-----Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
41C-----Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
42-----Granby	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
63B, 63C-----Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
63F-----Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
65C2, 65E2-----Lindley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65F2-----Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
83B-----Kenyon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
83C, 83C2-----Kenyon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
84-----Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
109C, 109E-----Backbone	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
110B-----Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
110C, 110E-----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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
118----------------- Garwin	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
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---------------- Tama	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
129B*:										
Arenzville---------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Chaseburg----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
133----------------- Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
136----------------- Ankeny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
142----------------- Chaseburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
143B---------------- Brady	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
152----------------- Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
153----------------- Shandep	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
159, 159C----------- Finchford	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
162B---------------- Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
162C, 162C2, 162D, 162D2------------- Downs	Fair	Good	Good	Good	Good	Very 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------------- Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163E, 163E2, 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.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
171B----- Bassett	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
171C, 171C2, 171D, 171D2----- Bassett	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
171E2----- Bassett	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
174B----- Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
174C----- Bolan	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
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.
177, 177B----- Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
178, 178B----- Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
184B----- Klinger	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
198B----- Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
221----- Palms	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
226----- Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
246, 246B----- Curran	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
284B----- Flagler	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
290----- Dells	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
291B----- Atterberry	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
293C*: 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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
293C*:										
Fayette-----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
293D*:										
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.
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.
315*:										
Perks-------------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Poor	Very poor.
Chaseburg---------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
320---------------- Arenzville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
350, 350B---------- Waukegan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
351---------------- Atterberry	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
352B--------------- Whittier	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
354. Aquolls										
377B--------------- Dinsdale	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
377C, 377C2-------- Dinsdale	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
381B*:										
Klinger-----------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Maxfield----------	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
382---------------- Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
391B*:										
Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
394B Ostrander	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
394C Ostrander	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
408B Olin	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
408C Olin	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
412C, 412E Emeline	Very poor.	Very poor.	Poor	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
428B Ely	Good	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
462B Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
462C Downs	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
463B Fayette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
463C Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
478G*:										
Nordness	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
480C, 480C2, 480D, 480D2 Orwood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
480E, 480E2, 480F2 Orwood	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
484 Lawson	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
485 Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
489 Ossian	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
499D Nordness	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
499F-----Nordness	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
539-----Perks	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Poor	Very poor.
585*:										
Spillville--------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Coland------------	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
626-----Hayfield	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
673D2-----Timula	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
673E2-----Timula	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
703D-----Dubuque	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
703F-----Dubuque	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
760-----Ansgar	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
761B-----Franklin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
763D2-----Exette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
763E2, 763F2-----Exette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
771B-----Waubeek	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
771C, 771C2, 771D, 771D2-----Waubeek	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
775B-----Billett	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
775D-----Billett	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
775E-----Billett	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
778, 778B-----Sattre	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
809B-----Bertram	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	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
809C--------------- Bertram	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
814B, 814C--------- Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
817C--------------- Ripon	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
914C--------------- Winneshiek	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
914E--------------- Winneshiek	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
930---------------- Orion	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Good.
933---------------- Sawmill	Good	Good	Good	Fair	Fair	Good	Fair	Good	Fair	Fair.
976, 976B---------- Raddle	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
981B--------------- Worthen	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1291--------------- Atterberry	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
1291B-------------- Atterberry	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
5010*, 5030*. Pits										
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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
8B Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
8C Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
11B*:						
Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Ely	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
27B Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
27C Terril	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
41B Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
41C Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
42 Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
63B Chelsea	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
63C Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63F Chelsea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65C2 Lindley	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
65E2 Lindley	Severe: wetness, slope.	Moderate: wetness, shrink-swell, slope.	Severe: wetness, slope.	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
65F2-------------- Lindley	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
83B--------------- Kenyon	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
83C, 83C2--------- Kenyon	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
84---------------- Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
109C-------------- Backbone	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer, area reclaim.
109E-------------- Backbone	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope, thin layer, area reclaim.
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.	Severe: slope, frost action.	Severe: slope.
118--------------- Garwin	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness.
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-------------- Tama	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
129B*:						
Arenzville-------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Chaseburg--------	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.

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
133------------- Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
136------------- Ankeny	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
142------------- Chaseburg	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
143B------------ Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
152------------- Marshan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
153------------- Shandep	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
159------------- Finchford	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: small stones, droughty.
159C------------ Finchford	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: small stones, droughty.
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.
162D, 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------- Fayette	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, 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
163E, 163E2, 163F, 163F2, 163G------ Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
171B------------- Bassett	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
171C, 171C2------- Bassett	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
171D, 171D2------- Bassett	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
171E2------------ Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
174B------------- Bolan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
174C------------- Bolan	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
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.
177, 177B--------- Saude	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
178, 178B--------- Waukee	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
184B------------- Klinger	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
198B------------- Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.
221-------------- Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
226-------------- Lawler	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
246, 246B--------- Curran	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
284B-------------- Flagler	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
290--------------- Dells	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
291B-------------- Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
293C*:						
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*:						
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.
293F*:						
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.
315*:						
Perks------------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
Chaseburg--------	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
320--------------- Arenzville	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.

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
350, 350B--------- Waukegan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
351--------------- Atterberry	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
352B-------------- Whittier	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength.	Slight.
354. Aquolls						
377B-------------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
377C, 377C2------- Dinsdale	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
381B*: Klinger-----------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
Maxfield----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
382--------------- Maxfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
391B*: Clyde------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Floyd------------	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.
394B-------------- Ostrander	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
394C-------------- Ostrander	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
408B-------------- Olin	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
408C-------------- Olin	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
412C-------------- Emeline	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer, area reclaim.

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
412E: Emeline	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: thin layer, slope, area reclaim.
428B: Ely	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
462B: Downs	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
462C: Downs	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
463B: Fayette	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
463C: Fayette	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
478G*:						
Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, thin layer, area reclaim.
Rock outcrop.						
480C, 480C2: Orwood	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
480D, 480D2: Orwood	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
480E, 480E2, 480F2: Orwood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
484: Lawson	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
485: Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
489: Ossian	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
499D: Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: thin layer, area reclaim.

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
499F Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, thin layer, area reclaim.
539 Perks	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
585*:						
Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Coland	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
626 Hayfield	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
673D2 Timula	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
673E2 Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
703D Dubuque	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope, thin layer, area reclaim.
703F Dubuque	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
760 Ansgar	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, frost action, low strength.	Moderate: wetness.
761B Franklin	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
763D2 Exette	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
763E2, 763F2 Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
771B Waubeek	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: 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
771C, 771C2 Waubeek	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
771D, 771D2 Waubeek	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
775B Billett	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
775D Billett	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
775E Billett	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
778, 778B Sattre	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
809B Bertram	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer, area reclaim.
809C Bertram	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Moderate: thin layer, area reclaim.
814B Rockton	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: thin layer, area reclaim.
814C Rockton	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: depth to rock, shrink-swell, slope.	Moderate: depth to rock, shrink-swell.	Moderate: thin layer, area reclaim.
817C Ripon	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength, frost action.	Moderate: thin layer, area reclaim.
914C Winneshiek	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, low strength.	Moderate: thin layer, area reclaim.
914E Winneshiek	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
930 Orion	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
933 Sawmill	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: 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
976, 976B--------- Raddle	Slight---------	Slight---------	Slight---------	Slight---------	Severe: frost action.	Slight.
981B-------------- Worthen	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength, frost action.	Slight.
1291, 1291B------- Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
5010*, 5030*. Pits						
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," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
8B----------------- Judson	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
8C----------------- Judson	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
11B*:					
Colo---------------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Ely----------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
27B---------------- Terril	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
27C---------------- Terril	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
41B---------------- Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
41C---------------- Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
42----------------- Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
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.
63F---------------- Chelsea	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
65C2--------------- Lindley	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, 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
65E2: Lindley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: wetness, slope.	Fair: too clayey, slope, wetness.
65F2: Lindley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: wetness, slope.	Poor: slope.
83B: Kenyon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
83C, 83C2: Kenyon	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
84: Clyde	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
109C, 109E: Backbone	Severe: thin layer, seepage.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, thin layer, slope.
110B: Lamont	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
110C: Lamont	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
110E: Lamont	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
118: Garwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
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: Tama	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
129B*:					
Arenzville	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Chaseburg	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
133: Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, 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
136 Ankeny	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
142 Chaseburg	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
143B Brady	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
152 Marshan	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
153 Shandep	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
159, 159C Finchford	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
162B Downs	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
162C, 162C2 Downs	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
162D, 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 Fayette	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
163E, 163E2, 163F, 163F2, 163G Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
171B Bassett	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
171C, 171C2 Bassett	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
171D, 171D2 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
171E2. Bassett	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
174B. Bolan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
174C. Bolan	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
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.
177, 177B. Saude	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage, small stones.
178, 178B. Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
184B. Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
198B. Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
221. Palms	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding.
226. Lawler	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
246, 246B. Curran	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
284B. Flagler	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
290. Dells	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
291B. Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, 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
293C*:					
Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Lamont	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Fayette	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
293D*:					
Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Lamont	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope, thin layer.
Fayette	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
293F*:					
Chelsea	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
Lamont	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
315*:					
Perks	Severe: flooding, poor filter.	Severe: flooding, seepage.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Chaseburg	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
320 Arenzville	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
350, 350B Waukegan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
351 Atterberry	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness, thin layer.

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
352B Whittier	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
354. Aquolls					
377B Dinsdale	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
377C, 377C2 Dinsdale	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
381B*:					
Klinger	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
382 Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
391B*:					
Clyde	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
394B Ostrander	Slight	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
394C Ostrander	Slight	Severe: slope.	Slight	Slight	Fair: small stones.
408B Olin	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
408C Olin	Slight	Severe: slope.	Slight	Slight	Good.
412C Emeline	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
412E Emeline	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, thin layer, slope.
428B Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, 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
462B-----Downs	Slight-----	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey.
462C-----Downs	Slight-----	Severe: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
463B-----Fayette	Slight-----	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey.
463C-----Fayette	Slight-----	Severe: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
478G*:					
Nordness-----	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope, seepage.	Poor: area reclaim, slope, thin layer.
Rock outcrop.					
480C, 480C2-----Orwood	Slight-----	Severe: slope.	Slight-----	Slight-----	Good.
480D, 480D2-----Orwood	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
480E, 480E2, 480F2--Orwood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
484-----Lawson	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
485-----Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
489-----Ossian	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
499D-----Nordness	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
499F-----Nordness	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope, seepage.	Poor: area reclaim, slope, thin layer.
539-----Perks	Severe: flooding, poor filter.	Severe: flooding, seepage.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.

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
585*:					
Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
626 Hayfield	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
673D2 Timula	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
673E2 Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
703D Dubuque	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage, slope.	Poor: area reclaim, thin layer.
703F Dubuque	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
760 Ansgar	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
761B Franklin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
763D2 Exette	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
763E2, 763F2 Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
771B Waubeek	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
771C, 771C2 Waubeek	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
771D, 771D2 Waubeek	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
775B Billett	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

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
775D Billett	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
775E Billett	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
778, 778B Sattre	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
809B Bertram	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
809C Bertram	Severe: thin layer, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, thin layer.
814B Rockton	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
814C Rockton	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
817C Ripon	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
914C Winneshiek	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
914E Winneshiek	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
930 Orion	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
933 Sawmill	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
976 Raddle	Slight	Moderate: seepage.	Slight	Slight	Good.
976B Raddle	Slight	Moderate: seepage, slope.	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
981B----------------- Worthen	Slight------------	Moderate: seepage, slope.	Slight------------	Slight------------	Good.
1291, 1291B---------- Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
5010*, 5030*. Pits					
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," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
8B, 8C Judson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
11B*:				
Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
27B, 27C Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
41B, 41C Sparta	Good	Probable	Improbable: too sandy.	Poor: too sandy.
42 Granby	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
63B, 63C Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
63F Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
65C2 Lindley	Fair: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
65E2 Lindley	Fair: wetness, shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
65F2 Lindley	Poor: wetness, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
83B, 83C, 83C2 Kenyon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
84 Clyde	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
109C, 109E Backbone	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
110B, 110C Lamont	Good	Probable	Improbable: too sandy.	Good.
110E Lamont	Fair: slope.	Probable	Improbable: too sandy.	Poor: 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.	Improbable: excess fines.	Improbable: excess fines.	Good.
119B------------------ Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
120B, 120C------------ Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
129B*:				
Arenzville-----------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
Chaseburg------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
133------------------- Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
136------------------- Ankeny	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: large stones.
142------------------- Chaseburg	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
143B------------------ Brady	Fair: wetness.	Probable-------------	Probable-------------	Poor: small stones.
152------------------- Marshan	Fair: wetness.	Probable-------------	Probable-------------	Fair: area reclaim, thin layer.
153------------------- Shandep	Poor: wetness.	Probable-------------	Probable-------------	Poor: wetness.
159, 159C------------- Finchford	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: small stones.
162B, 162C, 162C2----- Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
162D, 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.	Good.
163D, 163D2----------- Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
163E, 163E2, 163F, 163F2---------------- Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
163G------------------ Fayette	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
171B, 171C, 171C2----- Bassett	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
171D, 171D2: Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
171E2: Bassett	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
174B, 174C: Bolan	Good	Probable	Improbable: too sandy.	Good.
175B, 175C: Dickinson	Good	Probable	Improbable: too sandy.	Good.
177, 177B: Saude	Good	Probable	Probable	Good.
178, 178B: Waukee	Good	Probable	Probable	Good.
184B: Klinger	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
198B: Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
221: Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
226: Lawler	Fair: wetness.	Probable	Probable	Poor: area reclaim.
246, 246B: Curran	Fair: wetness.	Probable	Improbable: too sandy.	Good.
284B: Flagler	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
290: Dells	Fair: wetness.	Probable	Improbable: too sandy.	Fair: thin layer.
291B: Atterberry	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
293C*:				
Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Lamont	Good	Probable	Improbable: too sandy.	Good.
Fayette	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
293D*:				
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.
293F*:				
Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Lamont	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
315*:				
Perks	Good	Probable	Improbable: too sandy.	Fair: small stones.
Chaseburg	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
320 Arenzville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
350, 350B Waukegan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
351 Atterberry	Fair: wetness.	Probable	Improbable: too sandy.	Good.
352B Whittier	Good	Probable	Improbable: too sandy.	Fair: thin layer.
354. Aquolls				
377B, 377C, 377C2 Dinsdale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
381B*:				
Klinger	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Maxfield	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
382 Maxfield	Fair: low strength, wetness.	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
391B*:				
Clyde	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
394B, 394C Ostrander	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
408B, 408C Olin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
412C, 412E Emeline	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
428B Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
462B, 462C Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
463B, 463C Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
478G*:				
Nordness	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope, thin layer.
Rock outcrop.				
480C, 480C2 Orwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
480D, 480D2 Orwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
480E, 480E2, 480F2 Orwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
484 Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
485 Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
489 Ossian	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
499D Nordness	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
499F: Nordness	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope, thin layer.
539: Perks	Good	Probable	Improbable: too sandy.	Fair: small stones.
585*:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
626: Hayfield	Fair: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim.
673D2: Timula	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
673E2: Timula	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
703D: Dubuque	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, thin layer.
703F: Dubuque	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
760: Ansgar	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
761B: Franklin	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
763D2: Exette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
763E2, 763F2: Exette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
771B, 771C, 771C2: Waubeek	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
771D, 771D2: Waubeek	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
775B: Billett	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
775D: Billett	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
775E Billett	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
778, 778B Sattre	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
809B, 809C Bertram	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
814B, 814C Rockton	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
817C Ripon	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, thin layer.
914C Winneshiek	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
914E Winneshiek	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
930 Orion	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
933 Sawmill	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
976, 976B Raddle	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
981B Worthen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1291, 1291B Atterberry	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
5010*, 5030*. Pits				
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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
8B, 8C Judson	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
11B*:						
Colo	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action, slope.	Wetness	Wetness.
Ely	Moderate: slope, seepage.	Moderate: wetness, piping.	Moderate: deep to water, slow refill.	Slope, frost action.	Erodes easily, wetness.	Erodes easily.
27B, 27C Terril	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
41B, 41C Sparta	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
42 Granby	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, too sandy, soil blowing.	Wetness, droughty.
63B, 63C Chelsea	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
63F Chelsea	Severe: slope, seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
65C2 Lindley	Moderate: slope.	Moderate: piping, wetness.	Severe: slow refill.	Slope	Wetness	Favorable.
65E2, 65F2 Lindley	Severe: slope.	Moderate: piping, wetness.	Severe: slow refill.	Slope	Slope, wetness.	Slope.
83B, 83C, 83C2 Kenyon	Moderate: slope, seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
84 Clyde	Severe: seepage.	Severe: wetness, thin layer.	Moderate: slow refill.	Frost action	Wetness, erodes easily.	Wetness, erodes easily.
109C Backbone	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, area reclaim.	Depth to rock, area reclaim.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
109E-------------- Backbone	Severe: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, area reclaim.	Slope, depth to rock, area reclaim.
110B, 110C-------- Lamont	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
110E-------------- Lamont	Severe: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
118--------------- Garwin	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness--------	Wetness.
119B-------------- Muscatine	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Wetness, erodes easily.	Erodes easily.
120B, 120C-------- Tama	Moderate: slope, seepage.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
129B*:						
Arenzville-------	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
Chaseburg--------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
133--------------- Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
136--------------- Ankeny	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
142--------------- Chaseburg	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
143B-------------- Brady	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, slope.	Wetness, soil blowing.	Wetness.
152--------------- Marshan	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Wetness.
153--------------- Shandep	Severe: seepage.	Severe: ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding--------	Wetness.
159, 159C--------- Finchford	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
162B, 162C, 162C2- Downs	Moderate: slope, seepage.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
162D, 162D2: Downs	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
163B, 163C, 163C2: Fayette	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
163D, 163D2, 163E, 163E2, 163F, 163F2, 163G: Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
171B, 171C, 171C2: Bassett	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
171D, 171D2, 171E2: Bassett	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope.
174B, 174C: Bolan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy	Favorable.
175B, 175C: Dickinson	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
177, 177B: Saude	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy	Favorable.
178, 178B: Waukee	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy	Favorable.
184B: Klinger	Moderate: seepage, slope.	Moderate: wetness, piping.	Moderate: deep to water, slow refill.	Frost action, slope.	Wetness, erodes easily.	Erodes easily.
198B: Floyd	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action, slope.	Wetness	Favorable.
221: Palms	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness, rooting depth.
226: Lawler	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Favorable.
246: Curran	Severe: seepage.	Severe: wetness.	Severe: cutbanks cave.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
246B: Curran	Severe: seepage.	Severe: wetness.	Severe: cutbanks cave.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
284B: Flagler	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
290: Dells	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
291B Atterberry	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
293C*:						
Chelsea	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
Lamont	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing	Favorable.
Fayette	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
293D*, 293F*:						
Chelsea	Severe: slope, seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
Lamont	Severe: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
315*:						
Perks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty, rooting depth.
Chaseburg	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
320 Arenzville	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
350, 350B Waukegan	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Erodes easily, too sandy.	Erodes easily.
351 Atterberry	Severe: seepage.	Moderate: thin layer, wetness.	Severe: cutbanks cave.	Frost action	Erodes easily, wetness.	Erodes easily.
352B Whittier	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily, too sandy.	Erodes easily.
354. Aquolls						
377B, 377C, 377C2 Dinsdale	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
381B*:						
Klinger	Moderate: seepage, slope.	Moderate: wetness, piping.	Moderate: deep to water, slow refill.	Frost action, slope.	Wetness, erodes easily.	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
381B*:						
Maxfield	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness, rooting depth.
382 Maxfield	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness, rooting depth.
391B*:						
Clyde	Severe: seepage.	Severe: wetness, thin layer.	Moderate: slow refill.	Frost action	Wetness, erodes easily.	Wetness, erodes easily.
Floyd	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action, slope.	Wetness	Favorable.
394B, 394C Ostrander	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
408B, 408C Olin	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Soil blowing	Favorable.
412C Emeline	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, area reclaim.	Depth to rock, area reclaim.
412E Emeline	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, area reclaim.	Slope, depth to rock, area reclaim.
428B Ely	Moderate: slope, seepage.	Moderate: wetness, piping.	Moderate: deep to water, slow refill.	Slope, frost action.	Erodes easily, wetness.	Erodes easily.
462B, 462C Downs	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
463B, 463C Fayette	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
478G*:						
Nordness	Severe: slope, depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, area reclaim.	Slope, erodes easily, depth to rock.
Rock outcrop.						
480C, 480C2 Orwood	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
480D, 480D2, 480E, 480E2, 480F2 Orwood	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
484-----Lawson	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
485-----Spillville	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable-----	Favorable.
489-----Ossian	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness-----	Wetness.
499D, 499F-----Nordness	Severe: slope, depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, area reclaim.	Slope, erodes easily, depth to rock.
539-----Perks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty, rooting depth.
585*:						
Spillville-----	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable-----	Favorable.
Coland-----	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness-----	Wetness.
626-----Hayfield	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Favorable.
673D2, 673E2-----Timula	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
703D, 703F-----Dubuque	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, area reclaim.	Slope, erodes easily, depth to rock.
760-----Ansgar	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness, erodes easily.	Wetness, erodes easily.
761B-----Franklin	Moderate: seepage, slope.	Moderate: wetness, piping.	Moderate: deep to water, slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
763D2, 763E2, 763F2-----Exette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
771B, 771C, 771C2-Waubeek	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
771D, 771D2-----Waubeek	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
775B-----Billett	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
775D, 775E-------- Billett	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
778, 778B--------- Sattre	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Favorable.
809B, 809C-------- Bertram	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, area reclaim.	Depth to rock, area reclaim.
814B, 814C-------- Rockton	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Depth to rock, area reclaim.	Depth to rock, area reclaim.
817C-------------- Ripon	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, area reclaim.	Erodes easily, depth to rock.
914C-------------- Winneshiek	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, area reclaim.	Depth to rock, area reclaim.
914E-------------- Winneshiek	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, area reclaim.	Slope, depth to rock, area reclaim.
930--------------- Orion	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
933--------------- Sawmill	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness--------	Wetness.
976--------------- Raddle	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
976B-------------- Raddle	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
981B-------------- Worthen	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
1291-------------- Atterberry	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
1291B------------- Atterberry	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
5010*, 5030*. Pits						
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: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
8B, 8C----------- Judson	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	8-34	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-50	15-25
	34-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	100	95-100	25-50	5-25
11B*:											
Colo------------	0-39	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	39-49	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	49-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Ely-------------	0-19	Silty clay loam	CL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	19-43	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	43-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
27B, 27C--------- Terril	0-32	Loam-------------	CL	A-6	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	32-60	Clay loam, loam, sandy loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0-5	95-100	90-100	65-95	35-85	20-40	5-20
41B, 41C--------- Sparta	0-17	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	17-30	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
	30-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
42--------------- Granby	0-10	Fine sandy loam	SM, SC, SM-SC	A-2, A-4	0	100	100	60-85	30-50	<30	NP-10
	10-40	Sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
	40-60	Sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
63B, 63C, 63F---- Chelsea	0-3	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	3-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
65C2, 65E2, 65F2- Lindley	0-8	Loam-------------	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
	8-60	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	10-20
83B, 83C, 83C2--- Kenyon	0-14	Loam-------------	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	14-51	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	51-60	Loam-------------	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20
84--------------- Clyde	0-17	Silty clay loam	OL, MH, ML, OH	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
	17-32	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	32-50	Sandy loam, loam, sandy clay loam.	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	50-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	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	
109C, 109E-------Backbone	0-14	Sandy loam--------	SM-SC, SC	A-2, A-4	0	100	100	75-85	15-40	15-25	5-10
	14-25	Sandy loam--------	SC, SM-SC	A-2, A-4	0-2	90-95	90-95	65-80	20-40	15-25	5-10
	25-36	Clay loam, clay, sandy clay loam.	CL, CH	A-6, A-7	2-5	90-95	90-95	70-80	50-75	35-55	20-30
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
110B, 110C, 110E-Lamont	0-9	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	9-17	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	17-52	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	52-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
118-------------Garwin	0-19	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	19-40	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	40-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	15-20
119B------------Muscatine	0-6	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	6-50	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	50-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
120B, 120C-------Tama	0-13	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	13-46	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	46-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
129B*:											
Arenzville------	0-26	Silt loam--------	ML, CL	A-4	0	100	100	95-100	80-95	20-30	4-10
	26-56	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-95	30-45	10-20
	56-60	Silt loam--------	CL, CL-ML	A-4	0	75-100	75-100	75-100	70-95	20-30	5-10
Chaseburg-------	0-10	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	85-100	<26	3-7
	10-60	Silt loam--------	ML, CL-ML, CL	A-4	0	85-100	85-100	85-100	85-100	<28	3-9
133-------------Colo	0-29	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	29-49	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
	49-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
136-------------Ankeny	0-38	Fine sandy loam	SM, SC	A-4, A-2	0-5	95-100	95-100	75-90	30-50	<25	2-10
	38-47	Fine sandy loam, sandy loam.	SM, SC	A-4, A-2	0-5	95-100	95-100	75-90	25-45	<25	2-10
	47-60	Loamy fine sand, fine sandy loam, fine sand.	SM, SC, SW-SM	A-4, A-2, A-3	0-5	95-100	95-100	70-80	5-40	<25	NP-10
142-------------Chaseburg	0-10	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	85-100	<26	3-7
	10-60	Silt loam--------	ML, CL-ML, CL	A-4	0	85-100	85-100	85-100	85-100	<28	3-9

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
143B------------- Brady	0-15	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-2, A-4, A-1	0-5	95-100	75-100	45-85	20-55	<25	NP-7
	15-39	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, ML, CL	A-2, A-4, A-6, A-1	0-5	85-100	60-100	35-90	20-55	15-35	NP-15
	39-48	Loamy sand, sandy loam.	SM, SC, SP-SM, SM-SC	A-2, A-4, A-1	0-5	95-100	75-100	35-70	10-40	<30	NP-10
	48-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-95	30-85	20-60	0-10	---	NP
152-------------- Marshan	0-15	Loam-------------	ML, CL	A-6, A-4	0	95-100	95-100	95-100	60-90	30-40	5-15
	15-29	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	29-35	Loam, sandy loam	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	75-100	70-90	45-75	25-40	5-15
	35-60	Coarse sand, gravelly coarse sand, sand.	SP, SW	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
153-------------- Shandep	0-7	Loam-------------	CL	A-6, A-7	0	95-100	95-100	90-100	85-95	30-45	10-20
	7-57	Silty clay loam, clay loam, loam.	CL	A-7	0	95-100	95-100	90-100	85-95	40-50	20-30
	57-60	Loamy sand, gravelly loamy coarse sand, gravelly coarse sand.	SW, SP	A-1	0-5	65-90	60-90	20-45	2-5	---	NP
159, 159C-------- Finchford	0-20	Loamy sand-------	SP-SM, SM	A-2, A-3	0	85-95	70-90	50-60	5-15	---	NP
	20-42	Sand, loamy sand, gravelly sand.	SW-SM, SP-SM	A-1	0	80-90	50-75	25-40	5-10	---	NP
	42-60	Gravelly sand, gravelly coarse sand, sand.	SW, SP	A-1	0	75-95	50-95	20-35	3-5	---	NP
162B, 162C, 162C2, 162D, 162D2----------- Downs	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	13-40	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	40-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163B, 163C, 163C2, 163D, 163D2, 163E, 163E2, 163F, 163F2, 163G----- Fayette	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	14-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
171B, 171C, 171C2, 171D, 171D2, 171E2---- Bassett	0-9	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	9-33	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
	33-60	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		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
174B, 174C-------Bolan	0-15	Loam-------------	CL, ML	A-4, A-6	0	100	100	85-95	50-70	30-40	5-15
	15-27	Loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	80-90	40-55	25-35	5-15
	27-38	Fine sandy loam	SM, SM-SC, SC	A-4	0	100	100	80-90	35-50	15-25	2-8
	38-60	Loamy fine sand, fine sand.	SM, SP-SM	A-2	0	100	100	70-85	10-30	---	NP
175B, 175C-------Dickinson	0-18	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	18-35	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	35-60	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
177, 177B--------Saude	0-14	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	14-27	Loam, sandy loam, gravelly sandy loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	65-95	60-85	45-60	20-30	5-15
	27-60	Loamy sand, gravelly coarse sand, sand.	SW-SM, GP-GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
178, 178B--------Waukee	0-21	Loam-------------	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	21-37	Loam, sandy clay loam, sandy 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
	37-60	Gravelly sand, loamy coarse sand, sand.	SW, SM, SP-SM, SP	A-1	2-10	60-90	60-85	20-40	3-25	---	NP
184B-------------Klinger	0-8	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	8-31	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	31-60	Loam, clay loam	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
198B-------------Floyd	0-23	Loam-------------	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	23-32	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	32-41	Sandy loam, loamy sand.	SM, SM-SC	A-2	2-5	90-95	70-80	50-70	15-35	10-20	NP-5
	41-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
221--------------Palms	0-31	Sapric material	PT	A-8	0	---	---	---	---	---	---
	31-60	Silt loam, silty clay loam, loam.	CL-ML, CL, SC, SM-SC	A-4, A-6, A-7, A-2	0	85-100	60-100	35-95	15-90	20-45	5-20
226--------------Lawler	0-15	Silt loam--------	CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	15-38	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	38-60	Gravelly coarse sand, loamy sand, loamy coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP

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	
246, 246B-------- Curran	0-17	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	85-95	25-35	8-15
	17-46	Silty clay loam, silt loam.	CL	A-6, A-7, A-4	0	100	100	90-100	85-100	28-50	9-25
	46-58	Stratified silt loam to sand.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	100	80-100	35-75	20-30	4-11
	58-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	95-100	95-100	50-90	5-35	---	NP
284B------------- 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
	20-29	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	50-70	25-40	15-25	5-10
	29-60	Loamy sand, gravelly sand, sand.	SP-SM, SW, SP, SW-SM	A-1	0-5	70-90	70-85	20-40	3-12	---	NP
290-------------- Dells	0-16	Silt loam--------	CL	A-4	0	100	100	95-100	90-95	25-30	7-10
	16-31	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-95	30-45	11-20
	31-36	Loam, sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	100	60-100	40-75	20-35	4-14
	36-60	Sand, loamy sand	SP-SM, SM, SP	A-3, A-1	0	90-100	90-100	45-100	0-15	---	NP
291B------------- Atterberry	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	14-42	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	95-100	35-55	15-30
	42-60	Silt loam, loam	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
293C*, 293D*, 293F*:											
Chelsea--------	0-3	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	3-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
Lamont---------	0-9	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	9-17	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	17-52	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	52-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
Fayette--------	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	14-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
315*:											
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
Chaseburg-------	0-10	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	85-100	<26	3-7
	10-60	Silt loam--------	ML, CL-ML, CL	A-4	0	85-100	85-100	85-100	85-100	<28	3-9

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	
320-------------- Arenzville	0-26	Silt loam--------	ML, CL	A-4	0	100	100	95-100	80-95	20-30	4-10
	26-56	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-95	30-45	10-20
	56-60	Silt loam--------	CL, CL-ML	A-4	0	75-100	75-100	75-100	70-95	20-30	5-10
350, 350B-------- Waukegan	0-11	Silt loam--------	ML	A-4	0	95-100	95-100	95-100	85-95	25-40	3-10
	11-37	Silt loam, 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 sand.	SP, SW, SP-SM	A-1	0-2	80-95	65-85	30-50	3-10	---	NP
351-------------- Atterberry	0-13	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	13-41	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	41-47	Sandy loam-------	SM-SC, SC	A-4	0	100	95-100	80-90	35-50	20-30	5-10
	47-60	Loamy sand, sand	SP-SM, SM, SM-SC	A-2, A-3	0	100	95-100	80-90	5-20	<20	NP-5
352B------------- Whittier	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-95	25-35	5-15
	14-35	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	15-25
	35-40	Loam, sandy loam	CL, SC	A-6, A-4	0	100	95-100	80-90	45-75	25-40	8-20
	40-60	Loamy fine sand, fine sand, loamy sand.	SM, SM-SC, SP-SM	A-2, A-3	0	100	95-100	80-90	5-20	<20	NP-5
354. Aquolls											
377B, 377C, 377C2----------- Dinsdale	0-7	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	7-30	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	30-60	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
381B*: Klinger---------	0-8	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
	8-31	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	31-60	Loam, clay loam	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
Maxfield--------	0-19	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	19-35	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	35-60	Loam-------------	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
382-------------- Maxfield	0-19	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	19-35	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	35-60	Loam-------------	CL	A-6	0-5	90-95	85-90	75-85	55-65	25-35	10-20
391B*: Clyde-----------	0-17	Silty clay loam	OL, MH, ML, OH	A-7	0-5	95-100	95-100	80-90	55-75	45-60	15-25
	17-32	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	10-20
	32-50	Sandy loam, loam, sandy clay loam.	SM, SM-SC	A-2	2-5	80-95	75-90	50-80	15-35	15-20	NP-5
	50-60	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	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: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
391B*:											
Floyd-----------	0-23	Loam-------------	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	23-32	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	32-41	Sandy loam, loamy sand.	SM, SM-SC	A-2	2-5	90-95	70-80	50-70	15-35	10-20	NP-5
	41-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
394B, 394C------- Ostrander	0-14	Loam-------------	CL-ML, CL	A-4, A-6	0	100	95-100	90-95	70-90	25-40	5-15
	14-27	Loam, silt loam	CL, CL-ML	A-4, A-6	0-1	95-100	95-100	90-95	70-90	25-40	5-15
	27-46	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	2-5	95-100	75-100	65-90	45-65	25-35	10-15
	46-60	Loam-------------	CL	A-6	1-5	95-100	90-100	80-95	50-75	25-40	10-20
408B, 408C------- Olin	0-26	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	95-100	85-95	30-50	20-30	5-10
	26-46	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-95	80-90	45-65	25-35	10-20
	46-60	Loam, clay loam	CL	A-6	2-5	90-95	85-95	80-90	50-65	25-35	10-20
412C, 412E------- Emeline	0-9	Loam-------------	CL	A-6	0-10	85-100	85-100	85-100	70-100	25-40	11-23
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
428B------------- Ely	0-19	Silty clay loam	CL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	10-25
	19-43	Silty clay loam	CL	A-7, A-6	0	100	100	95-100	95-100	35-50	10-25
	43-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	10-20
462B, 462C------- Downs	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	13-40	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	40-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
463B, 463C------- Fayette	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	9-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	46-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
478G*:											
Nordness--------	0-5	Loam-------------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	5-8	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-90	30-45	15-25
	8-14	Silty clay loam, clay loam, loam.	CL	A-7, A-6	2-10	85-95	80-90	70-85	65-85	30-45	15-25
	14	Unweathered bedrock, weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
480C, 480C2, 480D, 480D2, 480E, 480E2, 480F2----------- Orwood	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-90	30-40	8-15
	7-54	Silt loam, loam, clay loam.	CL	A-6	0	100	100	85-95	60-80	30-40	10-20
	54-60	Silt loam, loam	CL	A-6	0	100	100	85-95	70-90	30-40	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	
484-------------- Lawson	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-40	5-20
	8-32	Silt loam, silty clay loam.	CL, CL-ML	A-4	0	100	100	90-100	85-100	20-30	5-10
	32-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	60-100	20-45	10-25
485-------------- Spillville	0-52	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	52-60	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
489-------------- Ossian	0-17	Silt loam--------	ML, CL, OL	A-6, A-7	0	100	100	100	95-100	35-50	10-25
	17-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	100	95-100	30-40	10-20
499D, 499F------- Nordness	0-5	Loam-------------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	5-8	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-90	30-45	15-25
	8-14	Silty clay loam, clay loam, loam.	CL	A-7, A-6	2-10	85-95	80-90	70-85	65-85	30-45	15-25
	14	Unweathered bedrock, weathered bedrock.	---	---	---	---	---	---	---	---	---
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
585*:											
Spillville------	0-52	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	52-60	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
Coland----------	0-16	Clay loam--------	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	16-50	Clay loam, silty clay loam.	CL	A-7, A-6	0	100	100	95-100	65-80	35-50	15-25
	50-60	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
626-------------- Hayfield	0-8	Loam-------------	CL-ML, CL	A-6, A-4	0	100	100	90-98	70-90	25-40	6-15
	8-30	Loam, silt loam, clay loam.	CL-ML, CL	A-4, A-6	0	95-100	90-100	70-90	65-80	25-40	6-15
	30-60	Coarse sand, gravelly coarse sand, sand.	SP, SP-SM, SM	A-1	0-3	85-100	50-98	25-50	0-15	---	NP
673D2, 673E2----- Timula	0-5	Silt loam--------	ML, CL-ML	A-4	0	100	100	95-100	85-100	25-35	NP-10
	5-60	Silt loam, silt	ML, CL-ML	A-4	0	100	100	95-100	85-100	25-35	NP-10
703D, 703F------- Dubuque	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-34	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	34-38	Clay, silty clay	CH	A-7	2-10	85-95	80-90	70-85	65-85	50-70	30-45
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
760-------------- Ansgar	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	15-31	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	31-60	Loam, sandy clay loam, clay loam.	CL, SC	A-6	2-5	90-95	85-95	75-85	45-65	25-35	10-20
761B------------- Franklin	0-19	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	19-32	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	32-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	95-100	90-95	75-85	55-65	25-35	10-20
763D2, 763E2, 763F2----------- Exette	0-7	Silt loam--------	CL-ML, CL	A-4	0	100	100	100	95-100	25-35	5-10
	7-33	Silt loam--------	CL	A-6, A-4	0	100	100	100	95-100	30-40	7-15
	33-60	Silt loam--------	CL	A-4, A-6	0	100	100	100	95-100	30-40	7-15
771B, 771C, 771C2, 771D, 771D2----------- Waubeek	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	100	25-35	5-15
	10-26	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	100	40-50	15-25
	26-60	Loam, sandy clay loam, clay loam.	CL	A-6	0-5	90-95	85-95	75-85	50-65	25-35	10-20
775B, 775D, 775E- Billett	0-7	Sandy loam-------	SM, SM-SC, SC	A-2, A-4	0	100	95-100	60-100	25-50	<26	NP-8
	7-20	Sandy loam, fine sandy loam.	SM, SM-SC, SC	A-2, A-4	0-2	90-100	90-100	60-100	25-50	<28	NP-9
	20-42	Loamy sand, sandy loam, gravelly sandy loam.	SM	A-2, A-4	0-2	75-100	75-100	75-90	20-45	<21	NP-4
	42-60	Sand, fine sand	SM, SP-SM	A-2, A-4, A-1	0-2	80-100	75-100	40-95	10-40	---	NP
778, 778B-------- Sattre	0-10	Loam-------------	CL, CL-ML	A-4	0	100	90-100	70-90	50-75	25-35	5-10
	10-38	Loam, sandy clay loam, clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-100	80-100	70-95	40-60	20-35	5-15
	38-60	Sandy loam, sand, loamy sand.	SW, SM, SP, SP-SM	A-1	2-10	80-90	50-85	20-40	3-25	---	NP
809B, 809C------- Bertram	0-16	Fine sandy loam	SM-SC, SC, SM	A-2, A-4	0	100	95-100	85-95	30-50	25-35	5-10
	16-27	Sandy loam, fine sandy loam.	SM-SC, SC	A-2, A-4	0	100	95-100	80-90	25-40	15-25	5-10
	27-39	Sandy clay loam, clay loam.	SC, CL	A-6, A-7	0	85-95	80-90	70-80	45-65	35-45	20-30
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
814B, 814C------- Rockton	0-15	Loam-------------	CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	15-32	Loam, sandy clay loam, clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-7	0-5	95-100	90-100	70-100	40-75	25-45	5-20
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

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	
817C------------- Ripon	0-17	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	90-100	85-100	20-30	3-10
	17-24	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	10-25
	24-30	Clay loam, sandy clay loam, loam.	SC, CL	A-6, A-7	0-3	90-100	90-100	75-100	35-80	30-50	10-25
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
914C, 914E------- Winneshiek	0-11	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-70	20-30	5-15
	11-32	Loam, clay loam	CL	A-6	2-5	90-95	80-95	80-90	50-65	25-40	11-20
	32-34	Clay, silty clay	CH	A-7	2-10	85-95	80-95	80-90	70-90	55-70	30-45
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
930-------------- Orion	0-11	Silt loam--------	CL, CL-ML, ML	A-4	0	100	100	85-100	80-100	20-30	4-10
	11-28	Stratified silt loam to very fine sand.	CL, CL-ML, ML	A-4	0	100	100	90-100	70-80	20-30	4-10
	28-44	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	85-100	85-100	20-40	4-18
	44-60	Stratified silt loam to sand.	CL, CL-ML	A-4	0	80-100	80-100	80-100	80-100	20-30	4-10
933-------------- Sawmill	0-32	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	32-43	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	43-60	Silty clay loam, clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	75-100	65-95	20-50	8-30
976, 976B-------- Raddle	0-18	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	4-15
	18-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-35	4-15
981B------------- Worthen	0-21	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
	21-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
1291, 1291B------ Atterberry	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	14-42	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-35	5-15
	42-60	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	95-100	35-55	15-30
5010*, 5030*. Pits											
5040. Orthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" 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 K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
8B, 8C: Judson	0-8	24-27	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Low	0.28	5	6
	8-34	30-35	1.35-1.45	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.43		
	34-60	25-32	1.35-1.45	0.6-2.0	0.21-0.23	6.1-7.8	Moderate	0.43		
11B*:										
Colo	0-39	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.28	5	7
	39-49	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.28		
	49-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	0.28		
Ely	0-19	27-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.32	5	7
	19-43	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	0.43		
	43-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate	0.43		
27B, 27C: Terril	0-32	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.24	5	6
	32-60	15-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low	0.32		
41B, 41C: Sparta	0-17	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low	0.17	5	2
	17-30	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-7.3	Low	0.15		
	30-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-7.3	Low	0.15		
42: Granby	0-10	8-18	1.20-1.60	2.0-6.0	0.16-0.18	5.6-7.3	Low	0.20	5	3
	10-40	0-14	1.45-1.60	6.0-20	0.05-0.12	5.6-7.8	Low	0.17		
	40-60	0-10	1.45-1.60	6.0-20	0.05-0.09	6.6-8.4	Low	0.17		
63B, 63C, 63F: Chelsea	0-3	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low	0.17	5	2
	3-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-6.5	Low	0.17		
65C2, 65E2, 65F2: Lindley	0-8	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low	0.32	5	6
	8-60	25-35	1.35-1.55	0.2-0.6	0.14-0.18	4.5-6.5	Moderate	0.32		
83B, 83C, 83C2: Kenyon	0-14	20-25	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.28	5	6
	14-51	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.28		
	51-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Low	0.37		
84: Clyde	0-17	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	0.28	5	7
	17-32	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	0.37		
	32-50	10-22	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low	0.37		
	50-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Moderate	0.37		
109C, 109E: Backbone	0-14	8-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low	0.24	4	3
	14-25	12-18	1.55-1.65	2.0-6.0	0.11-0.13	5.1-7.3	Low	0.24		
	25-36	32-42	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.3	High	0.24		
	36	---	---	---	---	---	---	---		
110B, 110C, 110E: Lamont	0-9	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low	0.24	5	3
	9-17	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low	0.24		
	17-52	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-7.3	Low	0.24		
	52-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low	0.17		
118: Garwin	0-19	30-35	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	High	0.28	5	7
	19-40	27-35	1.28-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High	0.28		
	40-60	20-26	1.35-1.45	0.6-2.0	0.20-0.22	6.6-7.8	Moderate	0.28		
119B: Muscatine	0-6	24-27	1.28-1.32	0.6-2.0	0.22-0.24	5.1-7.3	Moderate	0.28	5	6
	6-50	30-35	1.28-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.43		
	50-60	22-30	1.35-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
120B, 120C-------- Tama	0-13	24-27	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6
	13-46	27-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43		
	46-60	22-28	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
129B*:										
Arenzville------	0-26	10-18	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.37	5	5
	26-56	10-30	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Moderate-----	0.37		
	56-60	10-20	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.37		
Chaseburg-------	0-10	12-16	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	5	5
	10-60	10-18	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.8	Low----------	0.37		
133-------------- Colo	0-29	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
	29-49	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28		
	49-60	25-35	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.28		
136-------------- Ankeny	0-38	10-18	1.50-1.55	2.0-6.0	0.16-0.18	6.1-7.3	Low----------	0.20	5	3
	38-47	10-16	1.55-1.65	2.0-6.0	0.15-0.17	6.1-7.3	Low----------	0.20		
	47-60	2-10	1.65-1.75	6.0-20	0.12-0.14	6.1-7.3	Low----------	0.20		
142-------------- Chaseburg	0-10	12-16	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	5	5
	10-60	10-18	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.8	Low----------	0.37		
143B------------- Brady	0-15	2-15	1.35-1.55	2.0-6.0	0.12-0.16	5.1-7.3	Low----------	0.20	5	3
	15-39	5-22	1.35-1.55	2.0-6.0	0.12-0.17	5.1-6.5	Low----------	0.24		
	39-48	5-20	1.35-1.50	2.0-6.0	0.08-0.13	5.1-7.3	Low----------	0.20		
	48-60	0-10	1.40-1.50	>20	0.02-0.04	5.6-8.4	Low----------	0.10		
152-------------- Marshan	0-15	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	4	6
	15-29	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28		
	29-35	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.28		
	35-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15		
153-------------- Shandep	0-7	26-27	1.35-1.40	0.6-2.0	0.20-0.23	6.1-7.8	Moderate-----	0.24	5	6
	7-57	26-32	1.40-1.60	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.24		
	57-60	2-8	1.60-1.70	6.0-20	0.02-0.04	6.1-8.4	Low----------	0.15		
159, 159C-------- Finchford	0-20	5-10	1.50-1.55	6.0-20	0.10-0.12	6.1-7.3	Low----------	0.17	5	2
	20-42	2-8	1.50-1.60	>20	0.04-0.06	5.1-6.5	Low----------	0.17		
	42-60	2-5	1.60-1.70	>20	0.02-0.04	5.1-7.3	Low----------	0.17		
162B, 162C, 162C2, 162D, 162D2----------- Downs	0-13	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.32	5	6
	13-40	26-35	1.30-1.35	0.6-2.0	0.18-0.20	4.5-7.3	Moderate-----	0.43		
	40-60	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, 163E, 163E2, 163F, 163F2, 163G----- Fayette	0-14	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	14-46	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
171B, 171C, 171C2, 171D, 171D2, 171E2---- Bassett	0-9	18-25	1.45-1.50	0.6-2.0	0.19-0.21	4.5-7.3	Low----------	0.28	5	6
	9-33	20-28	1.55-1.65	0.6-2.0	0.17-0.19	4.5-7.3	Low----------	0.28		
	33-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	5.1-8.4	Low----------	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
174B, 174C-------Bolan	0-15	20-26	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
	15-27	12-20	1.45-1.50	0.6-2.0	0.17-0.19	5.6-6.5	Low-----------	0.28		
	27-38	10-16	1.50-1.60	2.0-6.0	0.11-0.13	5.6-7.3	Low-----------	0.28		
	38-60	2-8	1.60-1.70	6.0-20	0.08-0.10	5.6-7.3	Low-----------	0.17		
175B, 175C-------Dickinson	0-18	10-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.20	4	3
	18-35	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low-----------	0.20		
	35-60	4-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low-----------	0.20		
177, 177B--------Saude	0-14	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
	14-27	12-18	1.40-1.50	0.6-6.0	0.15-0.19	5.1-6.0	Low-----------	0.28		
	27-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Low-----------	0.10		
178, 178B--------Waukee	0-21	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.24	4	6
	21-37	18-27	1.40-1.50	0.6-2.0	0.15-0.19	5.1-6.0	Low-----------	0.24		
	37-60	2-8	1.50-1.75	>20	0.02-0.06	5.6-6.5	Low-----------	0.10		
184B-------------Klinger	0-8	25-27	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	6
	8-31	28-35	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	31-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	5.6-7.8	Low-----------	0.43		
198B-------------Floyd	0-23	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6
	23-32	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low-----------	0.32		
	32-41	6-12	1.60-1.65	2.0-6.0	0.11-0.13	6.6-7.3	Low-----------	0.32		
	41-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low-----------	0.32		
221--------------Palms	0-31	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	5	2
	31-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----		
226--------------Lawler	0-15	18-27	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
	15-38	20-28	1.45-1.60	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.28		
	38-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low-----------	0.10		
246, 246B--------Curran	0-17	15-22	1.35-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	5
	17-46	18-30	1.45-1.65	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.43		
	46-58	10-20	1.55-1.65	0.6-2.0	0.06-0.22	5.1-7.3	Low-----------	0.43		
	58-60	1-4	1.55-1.65	6.0-20	0.05-0.10	5.1-7.3	Low-----------	0.15		
284B-------------Flagler	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
	20-29	10-15	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low-----------	0.20		
	29-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low-----------	0.20		
290--------------Dells	0-16	14-18	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	4	5
	16-31	20-32	1.55-1.65	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.43		
	31-36	10-25	1.55-1.65	0.6-2.0	0.12-0.19	5.1-7.3	Low-----------	0.32		
	36-60	2-8	1.55-1.70	6.0-20	0.05-0.10	5.1-7.3	Low-----------	0.15		
291B-------------Atterberry	0-14	20-26	1.20-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6
	14-42	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43		
	42-60	18-27	1.35-1.55	0.6-2.0	0.20-0.22	5.6-7.8	Low-----------	0.43		
293C*, 293D*, 293F*:										
Chelsea---------	0-3	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low-----------	0.17	5	2
	3-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-6.5	Low-----------	0.17		
Lamont----------	0-9	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low-----------	0.24	5	3
	9-17	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low-----------	0.24		
	17-52	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-7.3	Low-----------	0.24		
	52-60	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 THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
293C*, 293D*, 293F*:										
Fayette--------	0-14	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	14-46	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
315*:										
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
	8-60	2-10	1.50-1.75	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.15		
Chaseburg-------	0-10	12-16	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.37	5	5
	10-60	10-18	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.8	Low----------	0.37		
320-------------- Arenzville	0-26	10-18	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.37	5	5
	26-56	10-30	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Moderate-----	0.37		
	56-60	10-20	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.37		
350, 350B-------- Waukegan	0-11	18-27	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	4	6
	11-37	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		
351-------------- Atterberry	0-13	20-26	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.32	5	6
	13-41	28-34	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43		
	41-47	10-14	1.50-1.60	2.0-6.0	0.11-0.13	5.6-6.0	Low----------	0.24		
	47-60	2-8	1.60-1.70	6.0-20	0.05-0.10	5.6-7.3	Low----------	0.24		
352B------------- Whittier	0-14	18-24	1.25-1.30	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.32	4	6
	14-35	28-32	1.30-1.40	0.6-2.0	0.17-0.19	5.1-7.3	Moderate-----	0.43		
	35-40	12-18	1.50-1.60	0.6-2.0	0.16-0.18	5.1-6.0	Low----------	0.43		
	40-60	2-10	1.60-1.70	6.0-20	0.04-0.07	5.1-6.5	Low----------	0.17		
354. Aquolls										
377B, 377C, 377C2----------- Dinsdale	0-7	25-27	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	5	6
	7-30	30-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43		
	30-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	5.6-8.4	Low----------	0.43		
381B*:										
Klinger---------	0-8	25-27	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.32	5	6
	8-31	28-35	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43		
	31-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	5.6-7.8	Low----------	0.43		
Maxfield--------	0-19	30-35	1.35-1.40	0.6-2.0	0.21-0.23	6.6-7.3	High---------	0.24	5	7
	19-35	25-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.32		
	35-60	20-26	1.65-1.75	0.6-2.0	0.17-0.19	6.1-7.8	Low----------	0.32		
382-------------- Maxfield	0-19	30-35	1.35-1.40	0.6-2.0	0.21-0.23	6.6-7.3	High---------	0.24	5	7
	19-35	25-34	1.40-1.50	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.32		
	35-60	20-26	1.65-1.75	0.6-2.0	0.17-0.19	6.1-7.8	Low----------	0.32		
391B*:										
Clyde-----------	0-17	28-32	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	5	7
	17-32	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.37		
	32-50	10-22	1.60-1.70	2.0-6.0	0.11-0.13	6.1-7.3	Low----------	0.37		
	50-60	20-24	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Moderate-----	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	Pct	g/cc	In/hr	In/in	pH				
391B*:										
Floyd-----------	0-23	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.24	5	6
	23-32	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low----------	0.32		
	32-41	6-12	1.60-1.65	2.0-6.0	0.11-0.13	6.6-7.3	Low----------	0.32		
	41-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low----------	0.32		
394B, 394C------- Ostrander	0-14	18-27	1.45-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	6
	14-27	18-27	1.45-1.55	0.6-2.0	0.17-0.20	5.1-7.3	Low----------	0.28		
	27-46	13-27	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.28		
	46-60	18-27	1.60-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low----------	0.37		
408B, 408C------- Olin	0-26	12-18	1.45-1.50	2.0-6.0	0.13-0.15	5.6-7.3	Low----------	0.20	5	3
	26-46	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.32		
	46-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	6.6-8.4	Low----------	0.32		
412C, 412E------- Emeline	0-9	20-26	1.15-1.20	0.6-2.0	0.17-0.22	6.1-8.4	Moderate-----	0.32	2	4L
	9	---	---	---	---	---	-------------	----		
428B------------- Ely	0-19	27-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7
	19-43	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43		
	43-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate-----	0.43		
462B, 462C------- Downs	0-13	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.32	5	6
	13-40	26-35	1.30-1.35	0.6-2.0	0.18-0.20	4.5-7.3	Moderate-----	0.43		
	40-60	22-26	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43		
463B, 463C------- Fayette	0-9	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	9-46	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37		
	46-60	22-26	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37		
478G*:										
Nordness---------	0-5	18-24	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43	2	6
	5-8	22-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43		
	8-14	22-35	1.35-1.60	0.06-0.2	0.12-0.15	6.6-7.3	High---------	0.43		
	14	---	---	---	---	---	-------------	----		
Rock outcrop.										
480C, 480C2, 480D, 480D2, 480E, 480E2, 480F2----------- Orwood	0-7	18-24	1.35-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.32	5	6
	7-54	22-28	1.40-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.43		
	54-60	18-26	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43		
484-------------- Lawson	0-8	10-27	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.28	5	5
	8-32	10-30	1.20-1.55	0.6-2.0	0.18-0.22	6.1-7.8	Low----------	0.28		
	32-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43		
485-------------- Spillville	0-52	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6
	52-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28		
489-------------- Ossian	0-17	22-27	1.25-1.30	0.6-2.0	0.22-0.24	6.6-7.3	Moderate-----	0.28	5	6
	17-60	20-30	1.30-1.40	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.28		
499D, 499F------- Nordness	0-5	18-24	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43	2	6
	5-8	22-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43		
	8-14	22-35	1.35-1.60	0.06-0.2	0.12-0.15	6.6-7.3	High---------	0.43		
	14	---	---	---	---	---	-------------	----		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group
	In	Pct	g/cc	In/hr	In/in	pH				
539 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
	8-60	2-10	1.50-1.75	6.0-20	0.02-0.04	5.6-6.5	Low	0.15		
585*:										
Spillville	0-52	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.28	5	6
	52-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low	0.28		
Coland	0-16	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.28	5	6
	16-50	27-35	1.40-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.28		
	50-60	12-26	1.50-1.65	0.6-6.0	0.13-0.17	6.1-7.8	Low	0.28		
626 Hayfield	0-8	18-27	1.30-1.50	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.32	4	6
	8-30	18-30	1.40-1.55	0.6-2.0	0.17-0.22	5.1-6.0	Low	0.32		
	30-60	<5	1.55-1.65	6.0-20	0.02-0.04	5.6-7.8	Low	0.15		
673D2, 673E2 Timula	0-5	10-18	1.30-1.60	0.6-2.0	0.20-0.24	6.1-7.8	Low	0.37	5	5
	5-60	10-18	1.40-1.60	0.6-2.0	0.18-0.20	7.4-8.4	Low	0.37		
703D, 703F Dubuque	0-10	18-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-6.5	Low	0.37	4	6
	10-34	26-35	1.30-1.45	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	0.37		
	34-38	40-55	1.50-1.60	0.06-0.2	0.12-0.15	5.1-6.0	High	0.37		
	38	---	---	---	---	---	---	----		
760 Ansgar	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
	15-31	30-35	1.35-1.40	0.6-2.0	0.18-0.20	5.1-6.5	High	0.43		
	31-60	20-30	1.65-1.75	0.6-2.0	0.17-0.19	5.1-7.8	Low	0.43		
761B Franklin	0-19	18-25	1.30-1.35	0.6-2.0	0.21-0.23	4.5-7.3	Moderate	0.32	5	6
	19-32	30-34	1.35-1.40	0.6-2.0	0.18-0.20	4.5-6.0	Moderate	0.43		
	32-60	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-8.4	Low	0.43		
763D2, 763E2, 763F2 Exette	0-7	18-27	1.30-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Low	0.37	5	6
	7-33	20-27	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate	0.37		
	33-60	15-20	1.45-1.50	0.6-2.0	0.20-0.22	6.6-7.8	Moderate	0.37		
771B, 771C, 771C2, 771D, 771D2 Waubeek	0-10	19-24	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	0.32	5	6
	10-26	25-34	1.25-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.43		
	26-60	20-28	1.65-1.75	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.43		
775B, 775D, 775E Billett	0-7	5-15	1.40-1.70	2.0-6.0	0.13-0.18	4.5-7.8	Low	0.20	4	3
	7-20	6-18	1.40-1.70	2.0-6.0	0.10-0.17	4.5-7.3	Low	0.20		
	20-42	3-18	1.50-1.70	2.0-6.0	0.07-0.14	5.1-7.3	Low	0.20		
	42-60	1-10	1.60-1.70	6.0-20	0.03-0.10	5.1-7.8	Low	0.10		
778, 778B Sattre	0-10	18-24	1.40-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Low	0.28	4	6
	10-38	18-28	1.40-1.50	0.6-6.0	0.15-0.17	5.1-7.3	Low	0.28		
	38-60	2-8	1.50-1.75	>20	0.02-0.06	5.1-6.5	Low	0.15		
809B, 809C Bertram	0-16	8-15	1.50-1.55	2.0-6.0	0.12-0.14	6.1-7.3	Low	0.20	4	3
	16-27	12-18	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.0	Low	0.20		
	27-39	20-32	1.60-1.80	0.2-0.6	0.14-0.16	5.6-7.8	Moderate	0.20		
	39	---	---	---	---	---	---	----		
814B, 814C Rockton	0-15	18-27	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low	0.28	4	6
	15-32	18-25	1.40-1.60	0.6-2.0	0.16-0.19	5.1-7.3	Moderate	0.28		
	32	---	---	---	---	---	---	----		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
817C-------------	0-17	10-18	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.8	Low----------	0.28	4	5
Ripon	17-24	25-35	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.43		
	24-30	22-40	1.55-1.70	0.6-2.0	0.14-0.19	6.1-8.4	Moderate-----	0.32		
	30	---	---	---	---	---	-------------	----		
914C, 914E-------	0-11	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low----------	0.28	4	6
Winneshiek	11-32	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.3	Low----------	0.28		
	32-34	40-55	1.50-1.60	0.06-0.2	0.12-0.15	5.6-7.3	High---------	0.28		
	34	---	---	---	---	---	-------------	----		
930--------------	0-11	10-18	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.8	Low----------	0.37	5	5
Orion	11-28	10-18	1.20-1.30	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.37		
	28-44	10-30	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Low----------	0.37		
	44-60	10-18	1.20-1.40	0.6-2.0	0.18-0.22	5.6-7.8	Low----------	0.37		
933--------------	0-32	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28	5	7
Sawmill	32-43	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28		
	43-60	18-35	1.35-1.50	0.6-2.0	0.15-0.19	6.1-8.4	Moderate-----	0.28		
976, 976B--------	0-18	18-24	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6
Raddle	18-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43		
981B-------------	0-21	15-22	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6
Worthen	21-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.43		
1291, 1291B------	0-14	20-26	1.20-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6
Atterberry	14-42	15-26	1.20-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.32		
	42-60	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43		
5010*, 5030*. Pits										
5040. Orthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "occasional," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
8B, 8C: Judson	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Low.
11B*:												
Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
Ely	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
27B, 27C: Terril	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
41B, 41C: Sparta	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
42: Granby	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	Moderate	High	Low.
63B, 63C, 63F: Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
65C2, 65E2, 65F2: Lindley	C	None	---	---	2.0-3.5	Apparent	Nov-Apr	>60	---	Moderate	Moderate	Moderate.
83B, 83C, 83C2: Kenyon	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
84: Clyde	B/D	None	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High	High	Low.
109C, 109E: Backbone	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Low	Low.
110B, 110C, 110E: Lamont	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
118: Garwin	B/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
119B: Muscatine	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
120B, 120C: Tama	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
129B*:												
Arenzville-------	B	Occasional	Brief-----	Nov-Jun	3.0-6.0	Apparent	Nov-Jun	>60	---	High-----	Moderate	Moderate.
Chaseburg--------	B	Occasional	Very brief	Nov-Jun	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
133--------------- Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
136--------------- Ankeny	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
142--------------- Chaseburg	B	Frequent----	Very brief	Nov-Jun	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
143B-------------- Brady	B	None--------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High-----	Low------	Moderate.
152--------------- Marshan	B/D	None--------	---	---	1.0-2.5	Apparent	Oct-Jun	>60	---	High-----	High-----	Moderate.
153--------------- Shandep	B/D	None--------	---	---	+1-1.0	Apparent	Jan-Dec	>60	---	High-----	High-----	Moderate.
159, 159C--------- Finchford	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
162B, 162C, 162C2, 162D, 162D2------ Downs	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
163B, 163C, 163C2, 163D, 163D2, 163E, 163E2, 163F, 163F2, 163G------------- Fayette	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
171B, 171C, 171C2, 171D, 171D2, 171E2------------ Bassett	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
174B, 174C-------- Bolan	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
175B, 175C-------- Dickinson	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	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			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
177, 177B--------- Saude	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
178, 178B--------- Waukee	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
184B-------------- Klinger	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
198B-------------- Floyd	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
221--------------- Palms	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
226--------------- Lawler	B	None---------	---	---	2.0-4.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
246, 246B--------- Curran	C	None---------	---	---	1.0-3.0	Apparent	Sep-Apr	>60	---	High-----	High-----	High.
284B-------------- Flagler	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
290--------------- Dells	C	Rare---------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High-----	Low------	Moderate.
291B-------------- Atterberry	B	None---------	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Moderate.
293C*, 293D*, 293F*:												
Chelsea----------	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Lamont-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
Fayette----------	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
315*:												
Perks------------	A	Frequent----	Very brief to brief.	Feb-Nov	>6.0	---	---	>60	---	Low------	Low------	Moderate.
Chaseburg--------	B	Frequent----	Very brief	Nov-Jun	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
320--------------- Arenzville	B	Occasional	Brief-----	Nov-Jun	3.0-6.0	Apparent	Nov-Jun	>60	---	High-----	Moderate	Moderate.
350, 350B--------- Waukegan	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	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			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
351---------------- Atterberry	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
352B--------------- Whittier	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
354. Aquolls												
377B, 377C, 377C2- Dinsdale	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
381B*: Klinger-----------	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
Maxfield----------	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
382---------------- Maxfield	B/D	None---------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
391B*: Clyde-------------	B/D	None---------	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Floyd-------------	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
394B, 394C--------- Ostrander	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
408B, 408C--------- Olin	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
412C, 412E--------- Emeline	D	None---------	---	---	>6.0	---	---	4-12	Hard	Moderate	Low------	Low.
428B--------------- Ely	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
462B, 462C--------- Downs	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
463B, 463C--------- Fayette	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
478G*: Nordness----------	B	None---------	---	---	>6.0	---	---	8-20	Hard	Low------	Low------	Low.
Rock outcrop.												

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
480C, 480C2, 480D, 480D2, 480E, 480E2, 480F2----- Orwood	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
484--------------- Lawson	C	Occasional	Brief to long.	Mar-Nov	1.0-3.0	Apparent	Nov-May	>60	---	High-----	Moderate	Low.
485--------------- Spillville	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
489--------------- Ossian	B/D	Occasional	Very brief	Feb-Nov	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
499D, 499F-------- Nordness	B	None--------	---	---	>6.0	---	---	8-20	Hard	Low------	Low------	Low.
539--------------- Perks	A	Frequent----	Very brief to brief.	Feb-Nov	>6.0	---	---	>60	---	Low------	Low------	Moderate.
585*:												
Spillville-------	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
Coland-----------	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
626--------------- Hayfield	B	None--------	---	---	2.5-5.0	Apparent	Nov-Jun	>60	---	High-----	Low------	Moderate.
673D2, 673E2------ Timula	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
703D, 703F-------- Dubuque	B	None--------	---	---	>6.0	---	---	30-40	Hard	High-----	Moderate	Moderate.
760--------------- Ansgar	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
761B-------------- Franklin	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
763D2, 763E2, 763F2------------ Exette	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
771B, 771C, 771C2, 771D, 771D2------ Waubeek	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	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			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
775B, 775D, 775E-- Billett	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
778, 778B--------- Sattre	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
809B, 809C-------- Bertram	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Low------	Moderate.
814B, 814C-------- Rockton	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Low------	Low.
817C-------------- Ripon	B	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate	Moderate.
914C, 914E-------- Winneshiek	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
930--------------- Orion	C	Occasional	Brief-----	Mar-Nov	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
933--------------- Sawmill	B/D	Occasional	Brief to long.	Mar-Jun	0-2.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Low.
976, 976B--------- Raddle	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
981B-------------- Worthen	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
1291, 1291B------- Atterberry	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Moderate.
5010*, 5030*. Pits												
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
Ankeny	Coarse-loamy, mixed, mesic Cumulic Hapludolls
Ansgar	Fine-silty, mixed, mesic Mollic Ochraqualfs
Aquolls	Loamy, mixed, mesic Typic Haplaquolls
Arenzville	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Atterberry	Fine-silty, mixed, mesic Udollic Ochraqualfs
Backbone	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Bassett	Fine-loamy, mixed, mesic Mollic Hapludalfs
Bertram	Coarse-loamy, mixed, mesic Typic Hapludolls
Billett	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Bolan	Coarse-loamy, mixed, mesic Typic Hapludolls
Brady	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Chaseburg	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Chelsea	Mixed, mesic Alfic Udipsamments
Clyde	Fine-loamy, mixed, mesic Typic Haplaquolls
Coland	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
*Curran	Fine-silty, mixed, mesic Udollic Ochraqualfs
Dells	Fine-silty over sandy or sandy-skeletal, mixed, mesic Aquollic Hapludalfs
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dinsdale	Fine-silty, mixed, mesic Typic Argiudolls
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Dubuque	Fine-silty, mixed, mesic Typic Hapludalfs
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Emeline	Loamy, mixed, mesic Lithic Hapludolls
Exette	Fine-silty, mixed, mesic Dystric Eutrochrepts
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
Finchford	Sandy, mixed, mesic Entic Hapludolls
Flagler	Coarse-loamy, mixed, mesic Typic Hapludolls
Floyd	Fine-loamy, mixed, mesic Aquic Hapludolls
Franklin	Fine-silty, mixed, mesic Udollic Ochraqualfs
Garwin	Fine-silty, mixed, mesic Typic Haplaquolls
Granby	Sandy, mixed, mesic Typic Haplaquolls
Hayfield	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquollic Hapludalfs
Judson	Fine-silty, mixed, mesic Cumulic Hapludolls
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Klinger	Fine-silty, mixed, mesic Aquic Hapludolls
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
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
Nordness	Loamy, mixed, mesic Lithic Hapludalfs
Olin	Coarse-loamy, mixed, mesic Typic Hapludolls
*Orion	Coarse-silty, mixed, nonacid, mesic Aquic Udifluvents
Orthents	Loamy, mixed, mesic Udorthents
*Orwood	Fine-loamy, mixed, mesic Mollic Hapludalfs
Ossian	Fine-silty, mixed, mesic Typic Haplaquolls
Ostrander	Fine-loamy, mixed, mesic Typic Hapludolls
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Perks	Mixed, mesic Typic Udipsamments
Raddle	Fine-silty, mixed, mesic Typic Hapludolls
Ripon	Fine-silty, mixed, mesic Typic Argiudolls
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Sattre	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Saude	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Sawmill	Fine-silty, mixed, mesic Cumulic Haplaquolls
Shandep	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls

TABLE 18.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
*Tama	Fine-silty, mixed, mesic Typic Argiudolls
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
Timula	Coarse-silty, mixed, mesic Typic Eutrochrepts
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
Winneshiek	Fine-loamy, mixed, mesic Mollic Hapludalfs
Worthen	Fine-silty, mixed, mesic Cumulic Hapludolls

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