United States
Department of
Agriculture

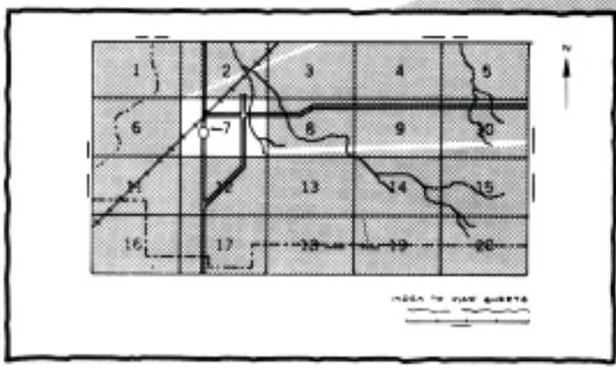
Soil
Conservation
Service

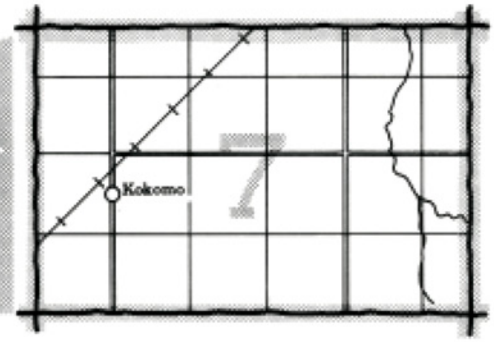
In cooperation with
the Iowa Agriculture
and Home Economics
Experiment Station;
the Cooperative Extension
Service, Iowa State
University; and Department
of Soil Conservation,
State of Iowa

Soil Survey of Dubuque County Iowa

HOW TO USE

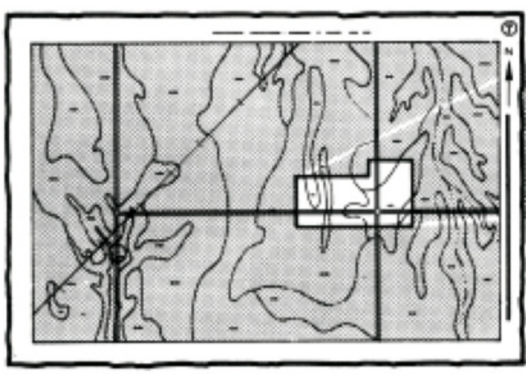
1. Locate your area of interest on the "Index to Map Sheets"

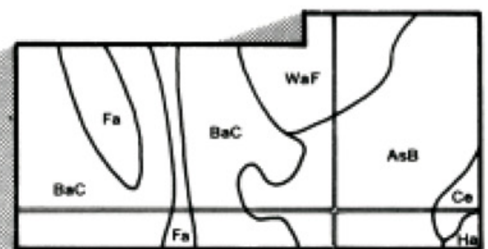




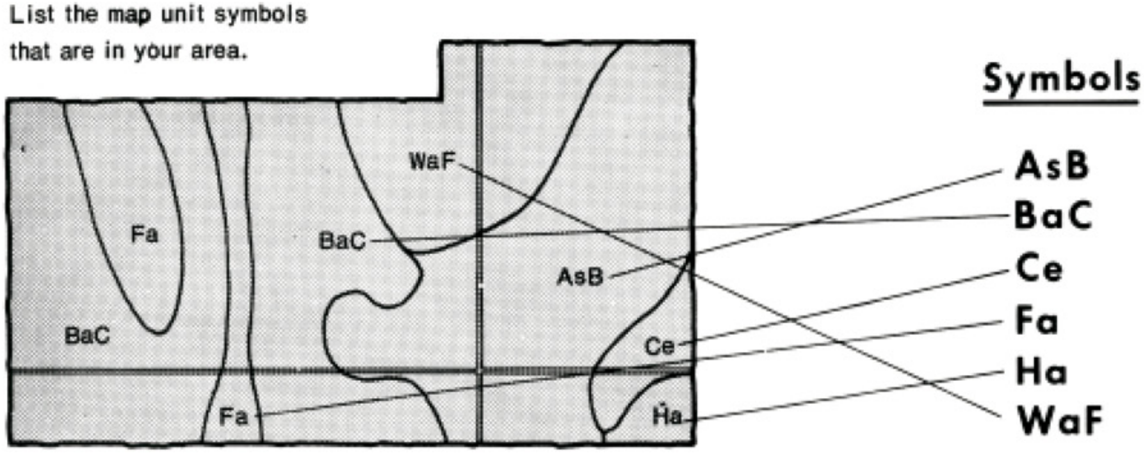
2. Note the number of the map sheet and turn to that sheet.

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



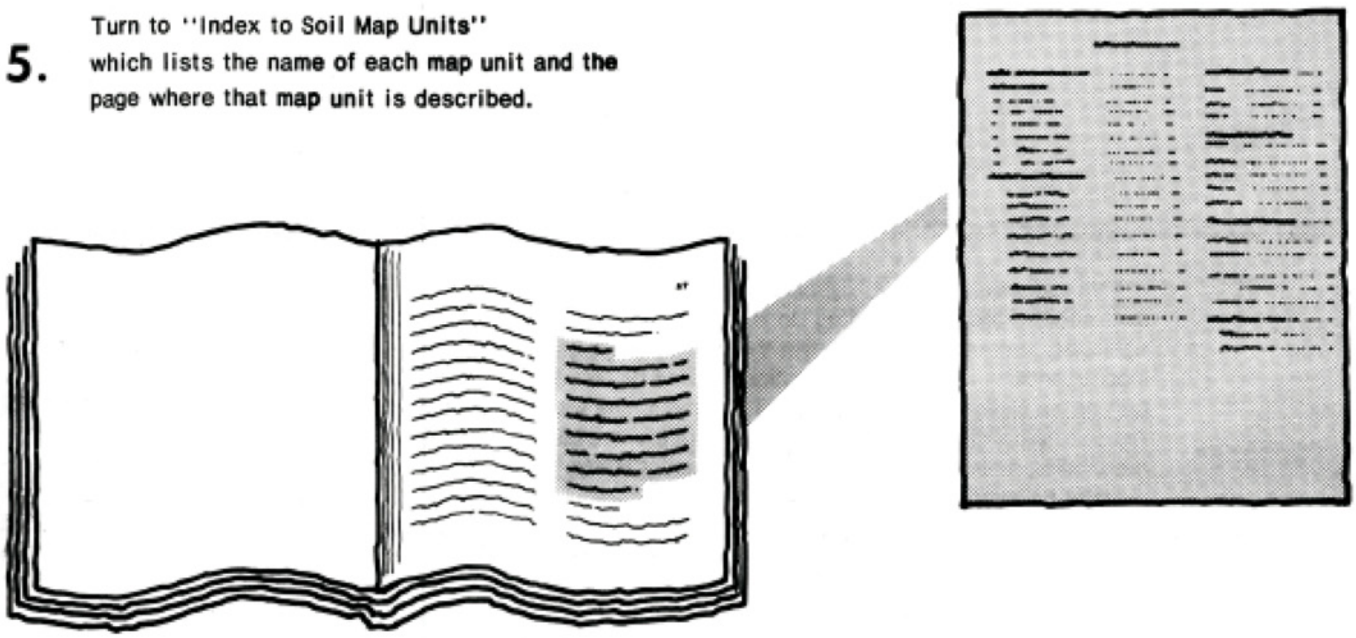


4. List the map unit symbols that are in your area.

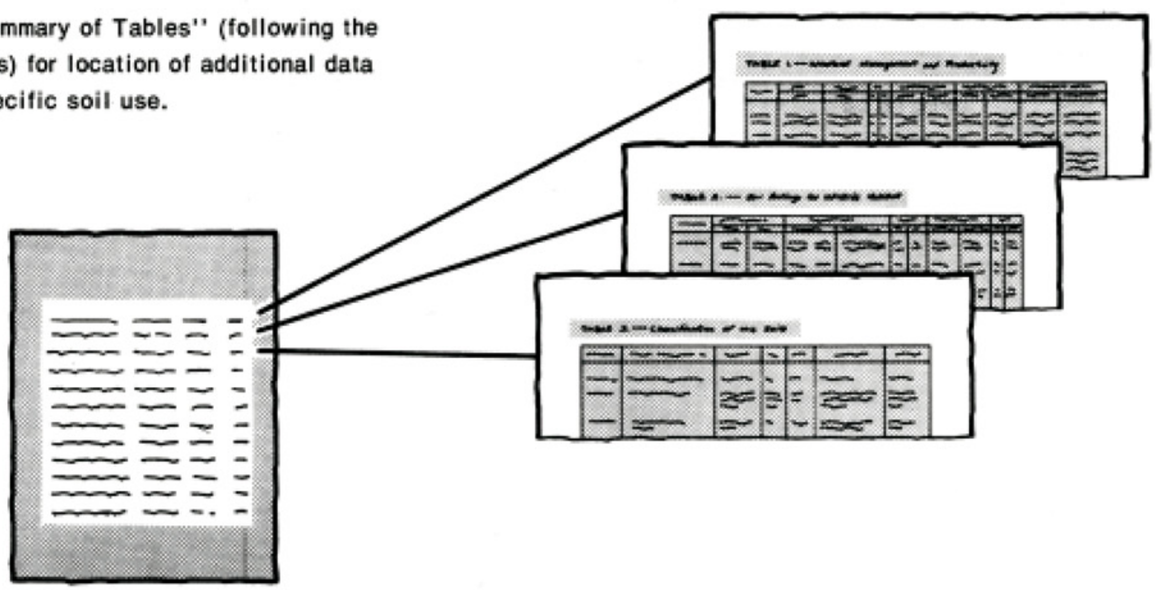


THIS SOIL SURVEY

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



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



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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. 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 Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Dubuque County Soil Conservation District. Funds appropriated by Dubuque County were used to defray part of the cost of the survey.

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

This soil survey supersedes a soil survey of Dubuque County published in 1923.

Cover: Typical landscape in an area of the Fayette-Rozetta-Eleroy soil association. Contour strips of alternating corn and hay and terraces help control erosion on the long slope.

Contents

Soil Series

Issued December 1985

Index to Map Units

Summary of Tables

Preface

This soil survey contains information that can be used in land-planning programs in Dubuque County, Iowa. 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 insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

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

Soil Survey of Dubuque County, Iowa

By Louis E. Boeckman, Soil Conservation Service

Fieldwork by Louis E. Boeckman, Kevin R. Funni, Frank L. Haynes, Ronald L. Reckner, Larry R. Sabata, Scott J. Switzer, and Clyde Wilson, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
the Iowa Agriculture and Home Economics Experiment Station;
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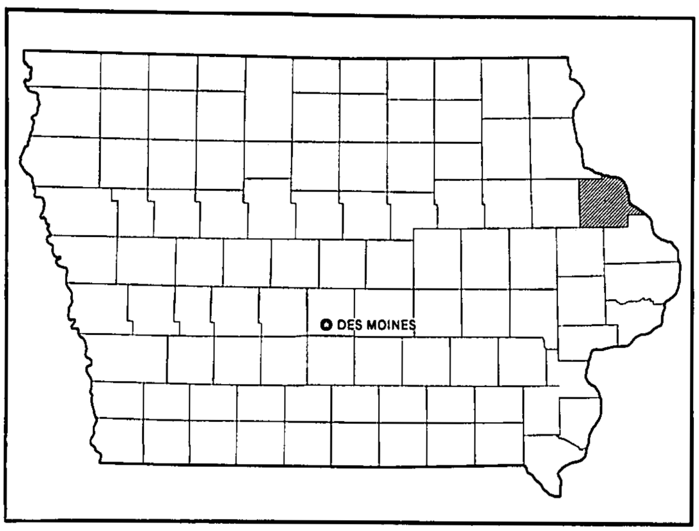

Figure 1.—Location of Dubuque County in Iowa.

DUBUQUE COUNTY is in the northeastern part of Iowa (fig. 1). It is bordered by Jackson and Jones Counties on the south, Delaware County on the west, and Clayton County on the north. The Mississippi River forms the eastern and northeastern boundaries, separating the county from Jo Daviess County, Illinois, and Grant County, Wisconsin. Dubuque County has a land area of 391,680 acres, or 612 square miles. Dubuque, the county seat, is in the east-central part of the county along the west bank of the Mississippi River and about 180 miles northeast of Des Moines, the state capital.

The county is chiefly agricultural. The principal crops are corn, oats, hay, and pasture. Corn is the most important crop sold, although much of the corn is fed to livestock. Dairy cattle, beef cattle, and hogs are the principal sources of income. The county ranks near the top in the state in the number of dairy cattle raised and amount of milk produced.

The county also offers some industry outside of agriculture for the tri-state area (Iowa, Wisconsin, and Illinois). Heavy equipment and light building materials are among the products manufactured in the county. Local plants also process meats from livestock from most of northeast Iowa and the tri-state area. There are livestock auction markets or buying stations in several towns in the county. Grain from grain elevators in Dubuque is shipped on barges down the Mississippi River.

Topography along the Mississippi River and lower reaches of its tributaries is very steep and rugged. Limestone bluffs rise abruptly to a height of 300 to 400 feet above the Mississippi River.

The other principal streams in the county are the Maquoketa and Little Maquoketa Rivers and Catfish Creek. These streams are of high gradient and are subject to flooding of high velocity and short duration in the spring and after heavy rainfall. Damage by flooding mainly occurs on the agricultural land in the county.

General Nature of the County

This section briefly describes transportation, history and development of the county, relief and drainage, natural resources, farming, and climate.

Transportation

All highways in the county intersect at Dubuque in the east-central part of the county, except for State Highway 136 which runs north and south along the western edge of the county. U.S. Highway 20, running mostly east and west, intersects the central part; U.S. Highway 61, running north and south, and U.S. Highway 151, running southwest and northeast, intersect the southern part; U.S. Highway 52, running northwest and southeast, intersects the eastern part; and State Highway 3 and U.S. Highway 52, running mostly east and west, intersect the northern part of the county. Concrete, asphalt, and crushed-rock roads connect all parts of the county to the major highways.

Most farmsteads are on all-weather roads. Dubuque, Peosta, Epworth, Farley, and Dyersville are on mainline railroads. Scheduled airline service is available at Dubuque and at Cedar Rapids and Waterloo, which are within 90 miles of the county.

There is a small municipal airport at Dyersville. Bus transportation is available on the north-south highways with connecting lines east and west at Dubuque. Motor freight lines serve every trading center in the county.

History and Development

In 1673, two Frenchmen, Joliet, an agent of the French Government, and Father Marquette, a priest from the Catholic Mission in Canada, explored the upper Mississippi region of North America, including the area that is now Dubuque County (*11*).

The Fox Indian tribe was the dominant tribe in the Dubuque area when Joliet and Marquette traveled through the area. Sac, Sioux, Miami, Iowa and Winnebago Indians lived nearby and were at times allies and enemies of the Fox Indians.

Shortly after Marquette and Joliet visited the region, a French soldier named Nicholas Perrot was sent to the Prairie du Chien region of Wisconsin to build a fort for use as a French outpost. In 1690, a group of Indians gave Perrot a piece of lead ore in an attempt to persuade him to build another fort close to their village to provide a ready market for furs. Perrot located the mine, which was near the mouth of Catfish Creek, and lead mining began to have a major impact on the development of the area.

In 1788, a French trader, Julien Dubuque, arrived in the Dubuque area and soon received permission from the Fox Indians to work their lead mines. Dubuque established the first white settlement in the territory that was to become Iowa. He worked the mines with great success until his death in 1810.

By 1833, after the Black Hawk Treaty had been signed between Chief Black Hawk of the Sac Indian tribe and the U.S. Government, there were settlements at Peru, Rockdale, Durango, Cascade, and Dyersville, as well as Dubuque. In 1833, the first schoolhouse in the territory was built in Dubuque. In 1834, sawmills and gristmills were built in the county, followed by a blast furnace in 1836 for smelting lead ore. By 1839, Loras College, the first college in Iowa, was established.

In the 1850's the Dubuque and Pacific Railroad came into the county, and in the period 1850 to 1860 the population of the county nearly tripled. Communities not served by the railroad soon faded out, and those on the line prospered. The railroad opened new marketplaces for farmers in the state.

Relief and Drainage

Dubuque County is mostly a dissected upland. About half of the county is drained by the eastward flowing Little Maquoketa and Tete des Morts Rivers and Catfish Creek. The rest of the county is drained westward and southward by the North Branch of the Maquoketa River and Johns, Whitewater, and Lytle Creeks. The Little Maquoketa and Tete des Morts Rivers and Catfish Creek empty directly into the Mississippi River, which flows southward along the eastern border of the county. The tributaries in the remaining part of the county empty into the Maquoketa River, which passes through Delaware, Jones, and Jackson Counties on the western and southern borders of Dubuque County.

The highest elevation in the county is about 1,230 feet in the northwestern part of the county. The elevation drops to a low of about 600 feet above sea level along the Mississippi River in the southeastern part near Massey Station.

The topography in the county, except in areas in the southwestern part, is characterized by gently rolling to hilly or steep relief. Typical upland features are numerous outcrops of limestone and steep slopes. Topography along the Mississippi River and its tributaries is very steep and rugged (fig. 2). High limestone bluffs or steep rises are between the bottom lands and the highest upland ridges.

In contrast to this area, the topography in the southwest corner of the county is characterized by gently undulating to undulating relief. Typical upland features are the generally flat horizon and low relief. Topography along the rivers is more sloping, and limestone outcrops are common in these areas.

Sinkholes are scattered throughout the county and are a major factor in the drainage of the county. Sinkholes are common on narrow upland ridges in the northern and central parts of the county. A few are open at the surface and are increasing in size. Many others are

Figure 2.—The escarpment of the Galena Limestone Formation, in an area of Nordness-Rock outcrop complex, 18 to 60 percent slopes, shows the relief in Dubuque County along the Mississippi River. Such areas typically are woodland.

mantled with soil material and are not growing. Some sinkholes are shallow and are cultivated, but many are deep and cannot be crossed by farm machinery. Each year several new sinkholes form, generally after a period of heavy precipitation.

Sinkholes are a possible cause of underground water pollution. In a few areas, surface water that carries barnyard runoff and septic tank effluent drains into sinkholes. This surface runoff moves directly into underground water supplies, which become polluted.

Natural Resources

Dubuque County is abundantly supplied with a variety of natural resources other than agricultural land. These include limestone, sand, gravel, trees, and water.

Limestone is near the surface in many areas throughout the county. The limestone is crushed and used commercially for road building and concrete and as a source of lime for agronomic uses. Some limestone may be used for decorative stone and for flagstone.

A few sand and gravel pits have been opened on the terraces adjacent to the Maquoketa and Little Maquoketa Rivers. The material is used extensively for road surfacing and as concrete aggregate.

The trees in the county are important commercially. A large quantity of walnut and oak logs are shipped out of the county, and cutting continues throughout the year. The natural beauty of the trees and limestone bluffs attracts many tourists to the county. Several parks have been developed on the scenic heights overlooking the Mississippi River.

The Mississippi River is used for transporting grain produced on farms throughout the northeastern part of Iowa. Grain terminals are located at Dubuque. Easy access is available to the river for boating and fishing.

Lead was once an important natural resource in the county. Remnants of old mining pits still exist near Durango and Dubuque (*4*). These pits are about 10 feet in diameter and about 30 to 40 feet deep. Spoil material generally surrounds the pits.

Farming

Farms in Dubuque County, like those across the midwest, have been increasing in size and decreasing in number. The number of farms decreased from 1,900 in 1976 to 1,690 in 1982 (*6*). Acreage per farm increased during this time from 188 to 209. The state average in 1982 was 289 acres per farm. The percentage of owner-operated farms in the county was 65 in 1982, which is more than the state average in the same year.

Farm production consists mainly of mixed livestock and grain crops. Some corn is sold as a cash crop, but the amount sold varies from year to year and depends largely on the price of feeder cattle, the market for fat cattle, the market for hogs, the cash price of corn, and the quality of the corn crop. The acreage in various grain crops in 1981 was corn for all purposes, 142,000 acres; oats, 32,800 acres; soybeans, 2,500 acres; and hay, 77,800 acres.

Dairy cattle, beef cattle, and hogs are the livestock most extensively raised in Dubuque County. In 1980, 400,000 hogs, 29,000 grain-fed cattle, and 3,200 grain-fed sheep and lambs were marketed. In 1982, according to the census of that year, 2-year-old milk cows numbered 36,000, 2-year-old beef cows numbered 22,100, and lambs numbered 2,500. Sows farrowed numbered 29,500 in the fall of 1980 and 31,500 in the spring of 1979.

Climate

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

Winters in Dubuque County are cold. Summers are hot, but there are occasional cool spells. Precipitation during winter frequently occurs as snowstorms. During the warm months, it occurs as showers, often heavy.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Dubuque, Iowa, in the period 1951 to 1979. 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 22 degrees F, and the average daily minimum temperature is 14 degrees. The lowest temperature on record, which occurred at Dubuque on March 1, 1962, is -32 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred at Dubuque on July 27, 1955, is 98 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 31 inches. Of this, 22 inches, or 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 17 inches. The heaviest 1-day rainfall during the period of record was 5.27 inches at Dubuque on August 2, 1972. Thunderstorms occur on about 45 days each year, and most occur in spring.

The average seasonal snowfall is about 32 inches. The greatest snow depth at any one time during the period of record was 32 inches. On the average, 38 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 northwest. Average windspeed is highest, 13 miles per hour, in spring.

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

How This Survey Was Made

This soil survey supersedes the soil survey of Dubuque County published in 1923 (*22*). This survey provides additional information and contains larger maps that show the soils in greater detail.

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 biologic 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 considerable 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, acidity, 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 interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were 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 were 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 state with a fairly high degree of probability 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 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.

1. Fayette-Nordness Association

Gently sloping to very steep, well drained, silty soils that formed in loess or silty surficial sediment and the underlying residuum of limestone; on uplands

This association consists of soils on convex ridgetops and side slopes. Narrow, meandering valleys surrounded by very steep side slopes with outcrops of limestone bedrock are characteristic of the areas (fig. 3). Limestone bluffs, 50 to 200 feet or more in height, along major streams and their tributaries, separate the bottom land from the higher uplands. The slope ranges from 2 to 60 percent.

This association makes up about 37 percent of the county. It is about 52 percent Fayette soils, 21 percent Nordness soils, and 27 percent soils of minor extent.

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

Typically, the surface layer of Fayette soils is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. It is yellowish brown, friable silt loam in the upper part; yellowish brown, friable silty clay loam in the middle part; and yellowish brown, friable silt loam with light brownish gray mottles in the lower part.

Typically, the surface layer of Nordness soils is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is brown, friable silty clay loam about 4 inches thick. Hard, fractured limestone is at a depth of about 13 inches.

Of minor extent in this association are areas of rock outcrops and of Arenzville, Chaseburg, Dubuque, Exette, and Lindley soils. Rock crops out on the lower part of steep and very steep side slopes, and it protrudes as bluffs and escarpments on the landscape. The moderately well drained Arenzville and Chaseburg soils formed in stratified silty alluvium and are along drainageways and on bottom lands. Dubuque soils formed in 20 to 40 inches of loess over limestone and are on nose slopes and the lower part of side slopes. Weakly developed Exette soils are in coves at the head of drainageways and on the lower part of side slopes. Lindley soils formed in firm glacial till, have moderately slow permeability, and are on the lower part of side slopes.

The principal concerns in management are erosion control and maintaining tilth and fertility. About one-half of the acreage is in cultivated crops. Many farmers cultivate the soils on parts of the ridgetops and in certain areas in the valleys. Many of the soils are suited to row crops in a rotation, but it is necessary to grow crops on the contour, construct terraces, use stripcropping, or use conservation tillage that leaves crop residue on the surface. Some areas require special care to prevent surface water from running down through sinkholes and polluting underground water supplies. The soils that are shallow over limestone can be used as pasture, woodland, or habitat for wildlife.

There are scenic areas within the association. Only a few winding roads cross the valleys, and the limestone bedrock crops out in many of the road cuts. Woodland and pasture border the bluffs in most places on uplands. Scattered trees grow along drainageways and fences, and there are many irregularly shaped timbered areas. Patches of oak-hickory forest that remain from the native vegetation are distinctive features of the landscape. The timbered areas range from 40 acres to 1,000 acres in size. The farmsteads are mostly on ridgetops; a few are in the small valleys. The fields are commonly small and

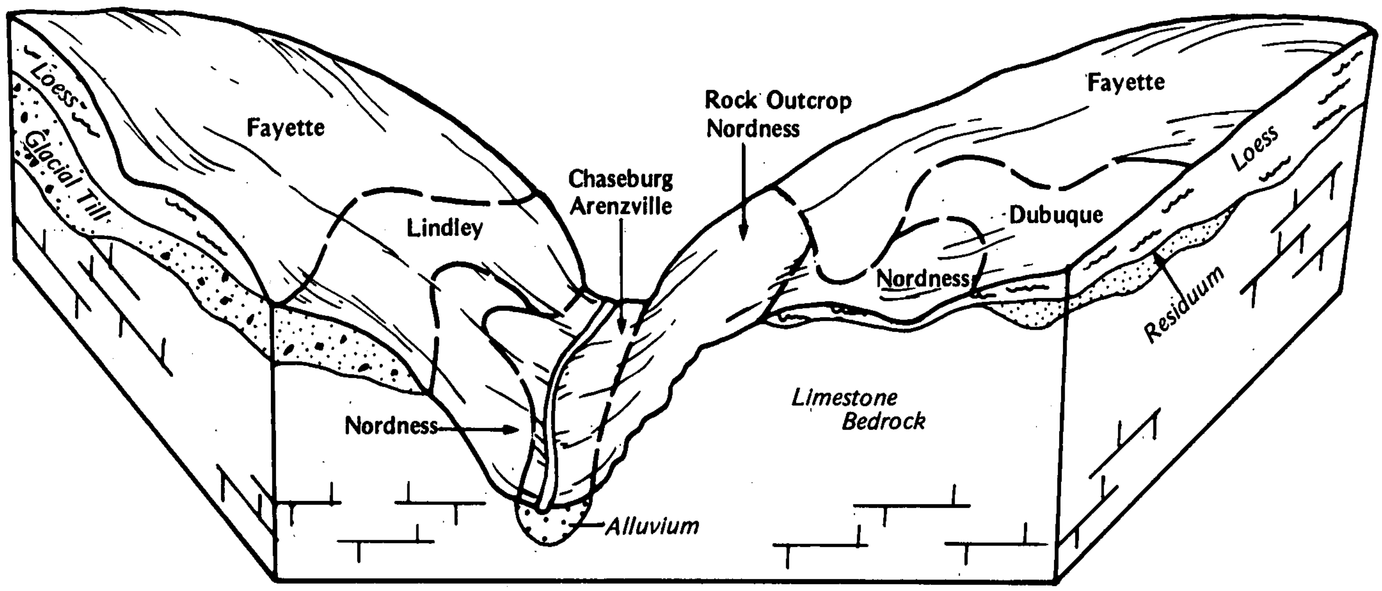

Figure 3.—Typical pattern of soils and underlying material in the Fayette-Nordness association.

have a variety of shapes. County roads seldom follow section lines.

Farming is diversified. Corn, oats, and hay are grown and are fed to beef cattle, dairy cattle, and hogs. The livestock also utilize the native pasture. The size of the average farm is about 200 acres, and the general trend is to larger farms.

Some areas within the city of Dubuque have been developed for residential and commercial uses. Runoff and erosion are major concerns during construction. Special onsite planning and installation of local control measures are necessary prior to and during construction.

2. Fayette-Rozetta-Eleroy Association

Moderately sloping to steep, well drained and moderately well drained, silty soils that formed in loess or in loess and the underlying residuum of shale; on uplands

This association consists of soils on convex, fingerlike ridgetops and convex and straight side slopes (fig. 4). The areas are dissected by many shallow, saucer-shaped drainageways on the upper part of the side slopes that develop into deeper, more distinct drainageways on the lower part of side slopes. The areas of this association are wedged between two major formations of limestone on the uplands. The slope ranges from 5 to 25 percent.

This association makes up about 18 percent of the county. It is about 43 percent Fayette soils, 25 percent Rozetta soils, 18 percent Eleroy and similar soils, and 14 percent soils of minor extent.

Fayette soils are well drained and are on moderately sloping to strongly sloping ridgetops and moderately steep to steep side slopes. Rozetta and Eleroy soils are on strongly sloping to moderately steep side slopes.

Typically, the surface layer of Fayette soils is dark grayish brown, friable silt loam about 7 inches thick. It has pockets of yellowish brown, friable silty clay loam, which is subsoil material. The subsoil is about 47 inches thick. The upper part is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Typically, the surface layer of Rozetta soils is brown and dark brown, friable silt loam about 7 inches thick. It has pockets of dark yellowish brown, friable silt loam, which is subsoil material. The subsoil is about 36 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the middle part is dark yellowish brown and yellowish brown, mottled, friable silty clay loam; and the lower part is mottled grayish brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam. Typically, shale is at a depth of 8 or 9 feet.

Typically, the surface layer of Eleroy soils is grayish brown and dark grayish brown, friable silt loam about 7 inches thick. It has pockets of dark yellowish brown, friable silt loam, which is subsoil material. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable silty clay loam; the middle part is yellowish brown, mottled, friable silty clay loam; and the lower part is mottled pale brown, yellowish brown, and light olive brown, friable silty clay loam. The substratum to a depth of about 44 inches is brown silty clay loam with chert fragments. The substratum is underlain by greenish gray and pale olive, clayey, calcareous shale.

The minor soils in this association are the Arenzville, Chaseburg, Dubuque, Nordness, and Schapville soils. Arenzville and Chaseburg soils formed in stratified silty alluvium in drainageways and on bottom lands. Dubuque and Nordness soils are shallow to limestone bedrock on the lower part of side slopes. Schapville soils formed in 15 to 30 inches of silty material over shale bedrock under grass vegetation. They are in small areas at the head of drainageways and on short steep escarpments.

Principal concerns in management are controlling erosion, wetness, and maintaining tilth and fertility. The soils on the ridges and the upper part of side slopes, for the most part, are cultivated. Permanent pasture and most woodland are confined to steeper areas on the lower part of side slopes and along drainageways.

In many areas, the soils are suited to row crops in rotation with oats and hay. Terraces, stripcropping, and conservation tillage, which leaves crop residue on the surface, help to control erosion (fig. 5). In some areas, drainage systems are needed to reduce wetness from drainageways and sidehill seeps for more timely tillage operations.

This association is surrounded by scenic areas. Many winding roads cross the valleys, and shale bedrock outcrops in many of the road cuts. Woodland and pasture border the escarpments and the lower part of side slopes on the uplands.

Scattered trees grow along drainageways and fences, and there are many irregularly shaped timber areas. Patches of oak-hickory forest that remain from the native vegetation are distinctive features on the landscape. Farmsteads are in valleys and on ridgetops. Fields are

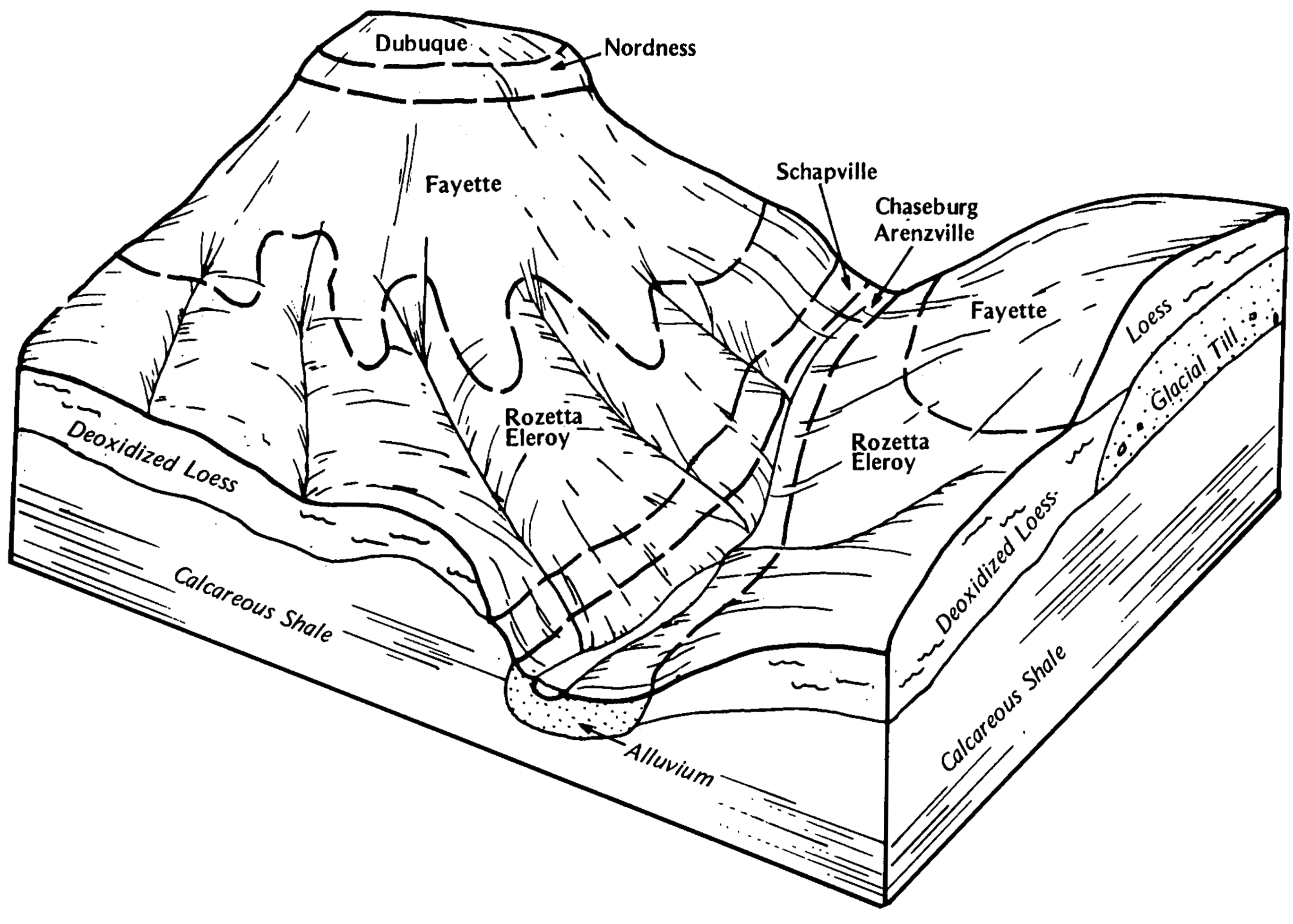

Figure 4.—Typical pattern of soils and underlying material in the Fayette-Rozetta-Eleroy association.

Figure 5.—Contour stripcropping is a common conservation practice used in areas of the Fayette-Rozetta-Eleroy association. The crops are alfalfa, hay, and corn.

commonly small and have a variety of shapes. County roads seldom follow section lines.

Farming is diversified. Corn, oats, and hay are grown and are fed to beef cattle, dairy cattle, and hogs. The livestock also utilize bluegrass pasture. The size of the average farm is about 200 acres. The trend is to larger farms.

Some areas near the city of Dubuque have been developed for residential and commercial uses. Runoff, erosion, and wetness are major concerns during construction. Special site investigation for thickness of the loess material over the less permeable parent material is necessary, in addition to site planning and installation of local control measures prior to and during construction. Additional drainage systems may also be needed because of a perched water table.

3. Downs-Tama Association

Gently sloping to moderately steep, well drained, silty soils that formed in loess; on uplands and stream benches

This association consists of soils on convex, moderately wide ridgetops and side slopes (fig. 6). The side slopes are dissected by many small drainageways. Scattered trees grow along drainageways and fences in some places. The farmsteads are mostly on ridgetops; a few are in small valleys. Fields are commonly small and have a variety of shapes. County roads generally follow section lines. The slope ranges from 2 to 18 percent.

This association makes up about 25 percent of the county. It is about 62 percent Downs soils, 10 percent Tama soils, and 28 percent soils of minor extent.

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

Typically, the surface layer of Downs soils is very dark grayish brown, friable silt loam about 7 inches thick. It has pockets of brown, friable silt loam subsoil material. The subsoil is about 43 inches thick. The upper part is brown and dark yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish brown, mottled, friable silty clay loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Typically, the surface layer of Tama soils is very dark brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and dark yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

The minor soils in this association are Exette, Newvienna, Nordness, Otter, Orion, and Atterberry soils. The moderately well drained Newvienna soils are near the head of drainageways and on the lower part of side slopes; Exette soils formed in deoxidized loess on convex side slopes and at the head of drainageways; Nordness soils, which are shallow to bedrock, are on the lower part of side slopes; poorly drained Otter and Orion soils are on bottom lands and to the areas along drainageways; Atterberry soils formed in loess, are somewhat poorly drained, and are on upland divides at the head of drainageways.

Principal concerns in management are controlling erosion and maintaining tilth and fertility. The soils in this association are used mainly for row crops in rotation with oats and hay. Permanent pastures are confined to the lower part of side slopes and to the areas along drainageways. Scattered trees are on the steeper slopes, which are not suitable for intensive cultivation, and along fences.

In many areas the soils are suited to row crops in a rotation if practices are used such as contouring,

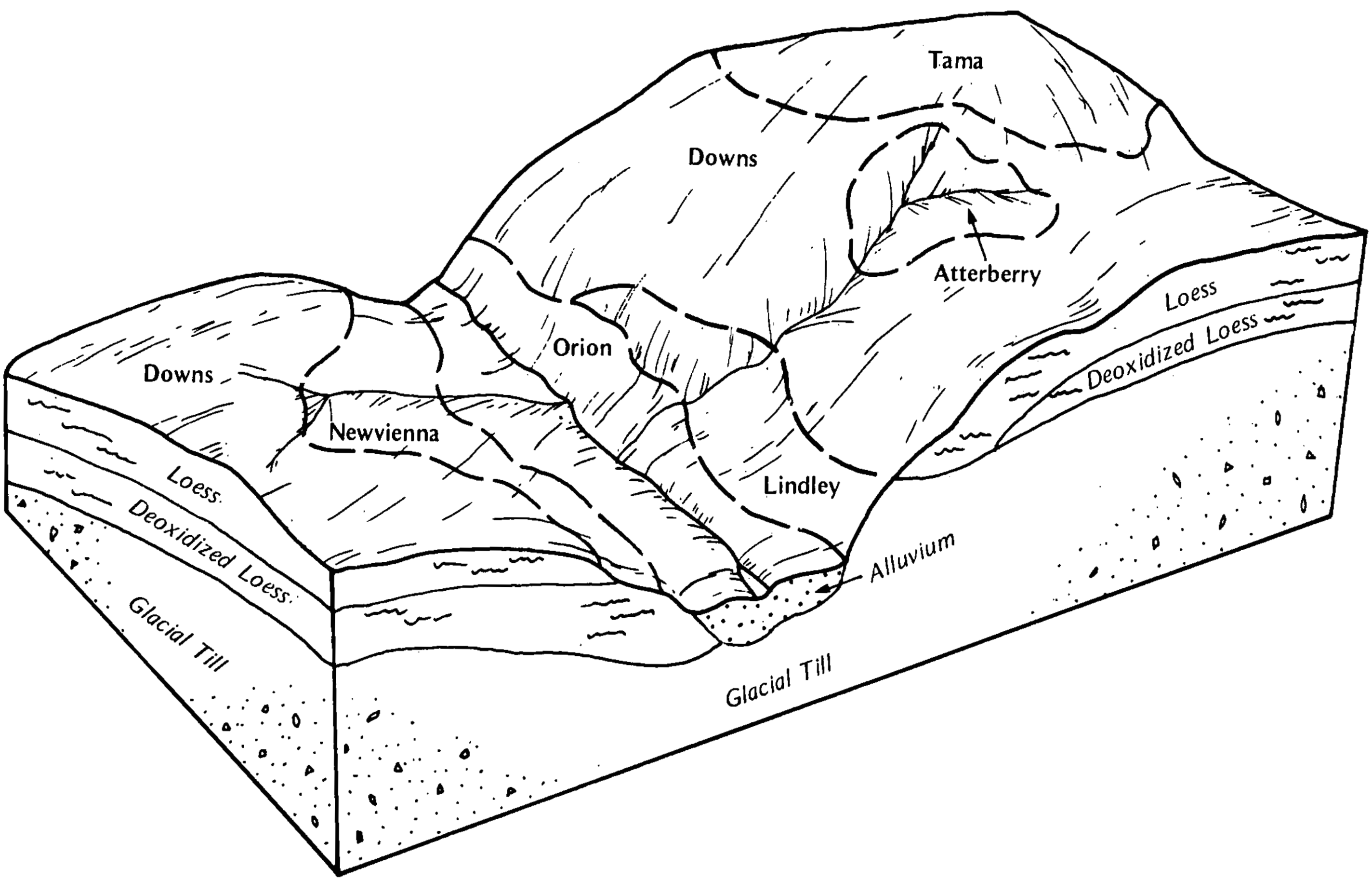

Figure 6.—Typical pattern of soils and underlying material in the Downs-Tama association.

terracing, stripcropping, or conservation tillage, which leaves crop resicue on the surface. In some areas, drainage systems are needed for more timely field operations. The soils that are shallow over limestone can be used as pasture, woodland, or habitat for wildlife.

The farmsteads are mostly on ridgetops; a few are in the lower valleys. The fields are commonly small. The slopes are generally smooth. County roads generally follow section lines.

Farming is diversified. Corn, oats, and hay are grown and are fed to beef cattle, dairy cattle, and hogs. The livestock often utilize improved grass pastures. The size of the average farm is about 200 acres, but farms in general are growing in size.

4. Downs-Orwood Association

Moderately sloping to steep, well drained, silty soils that formed in loess or in eolian sediment; on uplands

This association consists of soils on convex ridgetops and side slopes. A well-developed network of drainageways is characteristic of this association. Areas of this association generally occur as a transition between areas of the loess-covered uplands and areas of the loam-mantled glacial till uplands. The slope ranges from 5 to 25 percent.

This association makes up about 7 percent of the county. It is about 55 percent Downs soils, 31 percent Orwood soils, and 14 percent soils of minor extent.

Downs soils are well drained and are on moderately sloping ridgetops and strongly sloping to moderately steep side slopes. The Orwood soils are well drained and are on moderately sloping ridgetops and strongly sloping to steep side slopes.

Typically, the surface layer of the Downs soils is very dark grayish brown, friable silt loam about 7 inches thick. It has pockets of brown, friable silt loam subsoil material. The subsoil is about 46 inches thick. The upper part is brown and dark yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish brown, mottled, friable silty clay loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled silt loam.

Typically, the surface layer of the Orwood soils is very dark grayish brown, friable silt loam about 6 inches thick. It has pockets of brown, friable silt loam subsoil material. The subsoil is about 40 inches thick. The upper part is brown, friable silt loam; the middle part is dark yellowish brown and yellowish brown, friable silt loam and loam; and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam.

The minor soils in this association are Arenzville, Chaseburg, Dickinson, Fayette, and Lamont soils. The moderately well drained Arenzville and Chaseburg soils formed in stratified silty alluvium and are along drainageways. The well drained, loamy and sandy Dickinson and Lamont soils are on undulating, convex ridges and side slopes. The well drained Fayette soils formed under forest vegetation and are on the steeper side slopes.

Principal management concerns are controlling erosion and maintaining tilth and fertility. The soils in this association are used mainly for pasture or hay. Row crops typically are restricted to the ridges or are grown in areas adjacent to large areas of more productive soils. Pastures generally are adjacent to woodland areas, which are on the lower part of side slopes and along drainageways.

In many areas, the soils are suited to row crops or hay, but in some areas, the soils are subject to soil blowing. Farming on the contour, terracing, stripcropping, and conservation tillage, which leaves crop residue on the surface, help to reduce soil losses. Soils on steep side slopes should be left in hay, pasture, or trees.

Farming is diversified in areas of this soil association. Corn, oats, and hay are grown and are fed to beef cattle, dairy cattle, and hogs. Improved grass pastures are used by livestock. Nearby woodlands offer good wildlife habitat. The size of farms varies, but the average size is about 200 acres.

5. Racine-Bassett-Floyd Association

Very gently sloping to steep, well drained to somewhat poorly drained, loamy soils that formed in loamy surficial sediment and the underlying glacial till; on uplands

This association consists of soils on broad to moderately wide ridges, on moderately long to short convex side slopes, on concave foot slopes, and at the head of drainageways. Relief, in general, is low, and the network of drainageways is not well developed (fig. 7). The slope ranges from 1 to 25 percent.

This association makes up about 6 percent of the county. It is about 26 percent Racine and similar soils, 25 percent Bassett and similar soils, 12 percent Floyd soils, and 37 percent soils of minor extent.

Racine soils are well drained and are on gently sloping and moderately sloping ridges and moderately sloping to steep side slopes. Bassett soils are moderately well drained and are on gently sloping and moderately sloping ridges and moderately sloping to strongly sloping side slopes. Floyd soils are somewhat poorly drained and are on very gently sloping concave foot slopes and at the head of drainageways.

Typically, the surface layer of Racine soils is very dark grayish brown, friable loam about 8 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is brown and dark yellowish brown, friable loam and sandy clay loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

Typically, the surface layer of Bassett soils is very dark grayish brown, friable loam about 8 inches thick. The

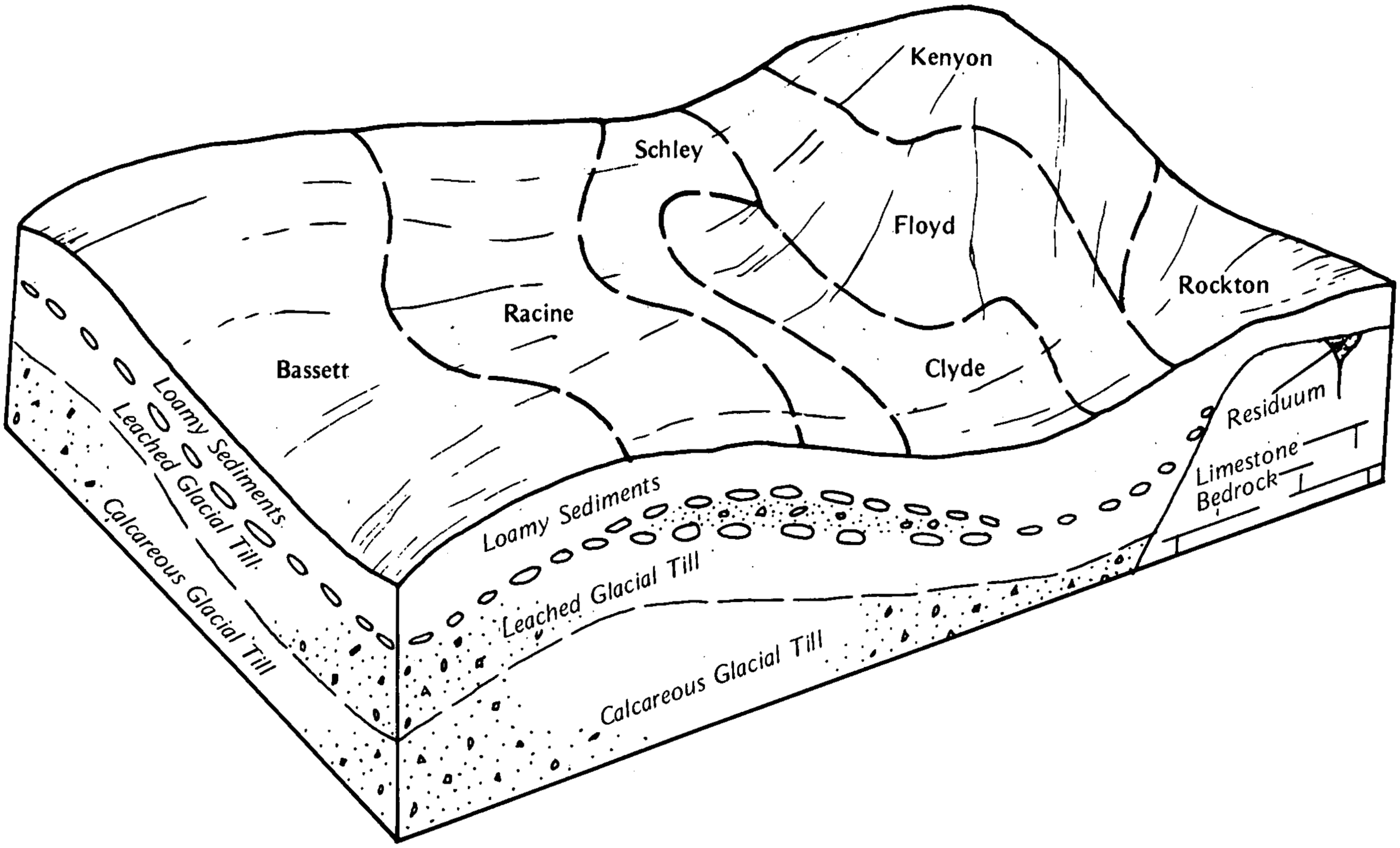

Figure 7.—Typical pattern of soils and underlying material in the Racine-Bassett-Floyd association.

subsurface layer is brown loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is yellowish brown, friable loam, and the lower part is strong brown and grayish brown, mottled, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

Typically, the surface layer of Floyd soils is black, friable loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable loam about 12 inches thick. The subsoil is about 32 inches thick. The upper part is dark grayish brown, friable loam; the middle part is light olive brown and grayish brown, friable loam with yellowish brown mottles; and the lower part is yellowish brown and light brownish gray, firm loam. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm loam.

The minor soils in this association are Clyde, Kenyon, Olin, Rockton, Schley, Sogn, and Winneshiek soils. The poorly drained Clyde soils are in the lower part of concave drainageways on the uplands. Kenyon soils are similar to Bassett soils except that they have a thicker and darker surface soil and are on broad ridges upslope from Bassett soils. Olin soils formed in loamy eolian material and the underlying glacial till on convex ridges and side slopes. Rockton and Winneshiek soils are shallow to limestone bedrock and are on convex ridges and side slopes. Schley soils are similar to Floyd soils except that they have a lighter colored subsurface horizon and are on higher toe slopes along drainageways. The somewhat excessively drained Sogn soils are on convex ridges and side slopes.

The soils in this association are used mainly for cultivated crops, but in small areas they are still in pasture and mixed hardwood timber. If properly managed, the soils are well suited to intensive row crop production.

The principal management concerns are improving drainage, controlling erosion, and maintaining tilth and fertility. The major soils in this association formed in loamy surficial sediment and the underlying firm loam glacial till. Water moves more rapidly in the loamy surficial sediment than in the firm glacial till. Therefore, the water accumulates along the contact between the two materials and moves downslope along this contact until it emerges as seepage on a side slope or saturates the upper layers of the soil on foot slopes or toe slopes. Contour tillage and terraces used to control erosion tend to aggravate the drainage problem. A combination of terraces and drainage tile is ggnerally effective in controlling both erosion and wetness. In some places, interceptor tile laid upslope from seepage areas is needed for drainage.

Farming is less diversified in this association than in any other association in the county. Corn and soybeans are the major crops grown. Dairy cattle are raised, although there is little pasture available. The size of farms ranges from 160 to 240 acres. The general trend is to larger farms.

6. Chelsea-Sogn-Lamont Association

Gently sloping to steep, excessively drained to well drained, sandy and loamy soils that formed in eolian sediment or residuum of limestone; on uplands and stream terraces

The landscape in the areas of this association is undulating and dunelike (fig. 8). The soils on the uplands are on narrow ridges and short, convex to straight side slopes. The soils on the high stream terraces are on convex, broad ridges and narrow side slopes; these soils are gently sloping to moderately sloping. The slope ranges from 2 to 25 percent.

This association makes up about 5 percent of the county. It is about 21 percent Chelsea and similar soils, 18 percent Sogn soils, 12 percent Lamont and similar soils, and 49 percent soils of minor extent.

Chelsea soils are excessively drained and are on moderately sloping ridges and moderately sloping to steep side slopes. Sogn soils are somewhat excessively drained and are on gently sloping to moderately sloping ridges and strongly sloping and moderately steep side slopes. Lamont soils are well drained and are on gently sloping to strongly sloping side slopes on high stream terraces and uplands.

Typically, the surface layer of Chelsea soils is dark brown and brown, very friable loamy fine sand about 5 inches thick. The subsurface layer is brown and yellowish brown, very friable loamy fine sand about 25 inches thick. Below that, to a depth of about 60 inches, there is light yellowish brown, loose fine sand. The sand has bands of brown sandy loam that are 1/4 inch to 2 inches thick.

Typically, the surface layer of Sogn soils is very dark brown, friable loam about 8 inches thick. It is underlain by level-bedded, indurated limestone bedrock that has dark colored soil material in the cracks and crevices.

Typically, the surface layer of Lamont soils is dark grayish brown, friable fine sandy loam about 7 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is yellowish brown and dark yellowish brown, friable and very friable sandy loam about 24 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand. It has nearly horizontal, strong brown layers of very friable loamy sand 1/2 inch to 2 inches thick.

Of minor extent in this association are areas of Udifluvents and of Backbone, Chaseburg, Terril, Wapsie, and Hayfield soils. Udifluvents formed in sandy stratified alluvium along the major stream channels. Backbone soils formed in 20 to 40 inches of eolian sediment over limestone on side slopes. Chaseburg soils formed in silty stratified alluvium on bottom land. The somewhat poorly drained Hayfield soils and the well drained Wapsie soils formed in loamy and sandy alluvium on stream terraces. Terril soils formed in colluvium along drainageways and on alluvial fans.

The soils in this association tend to be droughty and susceptible to wind and water erosion. Many areas of these soils are not suitable for cultivation and generally are used for pasture or hay or as woodland. Overgrazing can be a problem on these soils. The soils on stream terraces are more suited to row crop production; the principal management concerns are maintaining tilth and fertility. In some places, limestone near the surface restricts cultivation of the soils.

7. Dorchester-Caneek Association

Nearly level, moderately well drained and poorly drained, silty soils that formed in calcareous alluvial sediment; on bottom lands

The soils making up this association are on moderately wide flood plains that are bordered by limestone bluffs. The slope ranges from 0 to 2 percent.

This association makes up about 2 percent of the county. It is about 37 percent Dorchester soils, 16 percent Caneek soils, and 47 percent soils of minor extent.

Dorchester soils are moderately well drained and are on the slightly higher part of bottom lands and along drainageways. Caneek soils are poorly drained and typically are in channels, oxbows, and low-lying areas on bottom lands.

Typically, the surface layer of Dorchester soils is dark grayish brown, friable silt loam about 6 inches thick. It has very dark grayish brown strata. The next layer is a stratified substratum of dark grayish brown, very dark grayish brown, and brown, friable silt loam about 22 inches thick. It formed in recently deposited sediment. The underlying material to a depth of about 60 inches is a buried surface layer of black silt loam.

Typically, the surface layer of Caneek soils is dark grayish brown and grayish brown, friable silt loam about 10 inches thick. The next layer is stratified grayish brown, dark gray, gray, and olive gray, friable silt loam about 30 inches thick. It has reddish brown mottles. It formed in recently deposited sediment. The underlying material to a depth of about 60 inches is a buried surface layer of black silty clay loam.

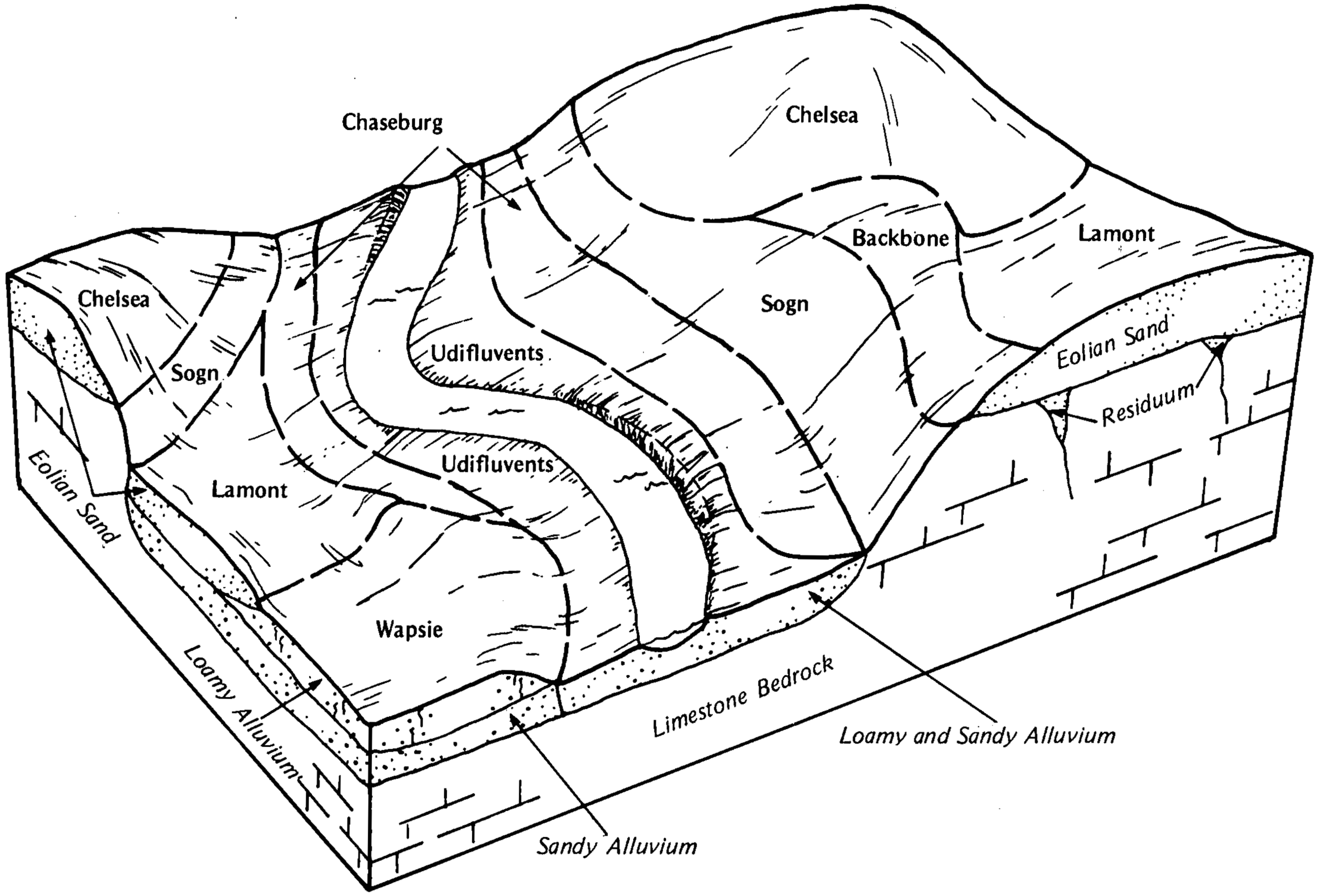

Figure 8.—Typical pattern of soils and underlying material in the Chelsea-Sogn-Lamont association.

Of minor extent in this association are areas of Psamments and of Dickinson, Lamont, Medary, and Zwingle soils. The excessively drained Psamments consist of sandy textured, river dredging material that has been redeposited in old channels, oxbows, and other lower lying areas along the Mississippi River within the city of Dubuque. Dickinson and Lamont soils formed in loamy eolian material on high stream terraces. Medary and Zwingle soils formed in clayey lacustrine deposits on high stream terraces.

The soils, in most areas of this association, are suited to row crops, but those on the bottom lands are flooded frequently. Most soils on the bottom lands are highly calcareous, which may adversely affect plant nutrient intake. The Caneek soils require drainage. Adequate outlets, however, generally are not available. As a result, some areas are left idle or are in pasture. The clayey, lacustrine soils on high stream terraces are generally not used for crops; they are used mainly for pasture or hay.

Some areas have been developed for residential and commercial uses within the cities of Dubuque and Sageville. Flooding, the availability of suitable material for individual septic tanks, and the high shrink-swell potential of the soils are major concerns during and after construction. Special onsite planning and installation of local control measures are necessary prior to and during construction. Many areas within the city of Dubuque are protected from flooding by a dike along the Mississippi River.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Fayette silt loam, 5 to 9 percent slopes, moderately eroded, is one of several phases in the Fayette 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. Chaseburg-Arenzville silt loams, 0 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. Pits, quarries, 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

27B—Terril loam, 2 to 5 percent slopes. This is a gently sloping, moderately well drained soil on foot slopes and along narrow drainageways below the more sloping loamy soils on uplands. Individual areas are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is very dark gray, friable loam about 8 inches thick. The subsurface layer is very dark grayish brown and dark brown, friable loam about 22 inches thick. The subsoil extends to a depth of about 60 inches. It is dark yellowish brown, friable loam in the upper part and yellowish brown, friable loam in the lower part. In some small areas, a sandy substratum is at a depth of about 40 inches.

Permeability of this Terril soil is moderate, and surface runoff is medium. The available water capacity is high The content of organic matter in the surface layer is about 4 or 5 percent. Typically, the surface layer is neutral or slightly acid. The upper part of the subsoil is medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops. This soil is well suited to corn, soybeans, and small grains. It is also well suited to grasses and legumes for hay and pasture. This soil is generally farmed along with the adjacent soils. The hazard of erosion is slight. This soil receives runoff water and sediment from soils upslope. Diversion terraces and conservation tillage, which leaves crop residue on the surface throughout the year, help to control runoff from the higher areas and to reduce excessive soil loss.

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

This soil is in capability subclass IIe.

41C—Sparta loamy fine sand, 3 to 9 percent slopes. This is a gently sloping to moderately sloping, excessively drained soil in areas adjacent to drainageways and in isolated areas on uplands. Individual areas are irregular in shape and range from 3 to 10 acres in size. In a few places, this soil is on dunelike, elongated ridges oriented in a northwest to southeast direction; these areas range from 10 to 20 acres in size.

Typically, in cultivated areas, the surface layer is very dark grayish brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown, very friable loamy fine sand about 15 inches thick. The subsoil is about 18 inches thick. The upper part is brown, very friable loamy fine sand, and the lower part is dark yellowish brown and yellowish brown, very friable loamy fine sand and loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In some places, the surface layer is lighter in color.

Included with this soil in mapping are small, scattered areas of gravelly loamy sand and gravelly sandy loam on the lower part of the uplands and on stream terraces. These areas are lower in organic matter content and available water capacity. The included areas make up less than 5 percent of this map unit.

Permeability of this Sparta soil is rapid, and surface runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. The subsoil is slightly acid to medium acid. It generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and is easily tilled throughout a wide range of moisture content. This soil seldom crusts after hard rains.

Some areas of this soil are cultivated, and some small areas are part of larger areas of soils that are better suited to crops than the Sparta soil. This soil is generally not suited to cultivated crops because erosion is a severe hazard. The soil is best suited to small grains, grasses, and deep-rooted legumes for hay or pasture. Droughtiness is a severe hazard in most years unless rainfall is timely. If this soil is used for cultivated crops, there is a hazard of wind erosion. Initial wind erosion occurs on rounded, convex shoulder slopes. Blowing sand grains sometimes damage newly seeded crops on this soil and on adjoining soils. Conservation tillage, a practice that leaves crop residue on the surface throughout the year, and cover crops help to reduce soil loss and conserve moisture. This soil warms up quickly in the spring, thus stimulating early vegetative growth, particularly on south- and east-facing slopes. Returning crop residue or the regular addition of other organic material helps to improve fertility and tilth and increase available water cpacity.

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

This soil is suited to trees, and some areas remain in hardwoods. Natural and planted seedlings do not survive well. Seedlings can be planted close together, and the surviving trees can be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards in planting or harvesting trees.

This soil is in capability subclass IVs.

63C—Chelsea loamy fine sand, 5 to 9 percent slopes. This is a moderately sloping, excessively drained soil on the uplands. It is on moundlike ridges and convex side slopes that typically blend with the landscape and generally are adjacent to stream valleys. This soil is also in isolated areas on glacial uplands and in moderately sloping areas on alluvial terraces. Individual areas are irregular in shape or are round and range from 3 to 30 acres in size.

Typically, the surface layer is dark brown and brown, very friable loamy fine sand about 9 inches thick. The subsurface layer is brown and yellowish brown, very friable fine sand about 28 inches thick. Below that, to a depth of about 60 inches, there is light yellowish brown, loose fine sand that has bands of brown sandy loam 1 inch to 2 inches thick.

Included with this soil in mapping are small areas of well drained Lamont soils in shallow drains. Lamont soils have a slightly higher available water capacity than the Chelsea soil. Also included are a few areas where bedrock is exposed at the surface. These areas make up less than 5 percent of this map unit.

Permeability of this Chelsea soil is rapid, and surface runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is less than 0.5 percent. Typically, reaction in the surface layer and the upper part of the subsurface layer varies widely as a result of local liming practices. The lower part of the subsurface layer is strongly acid. The subsurface layer generally is very low in available phosphorus and potassium. The surface layer is very friable and is easily tilled throughout a wide range of moisture content. This soil seldom crusts after hard rains.

Most areas of this soil are used as pasture or woodland. Some areas are cultivated, and some small areas are used for crops with larger areas of soils that are better suited to row crops than the Chelsea soil. This soil generally is not suited to row crops, such as corn and soybeans. It is better suited to small grains and grasses or deep-rooted legumes for hay or pasture. Droughtiness is a severe hazard in most years unless rainfall is timely. If this soil is used for cultivated crops, wind erosion is a hazard. Initial wind erosion occurs on rounded, convex shoulder slopes. Blowing sand grains sometimes damage newly seeded crops on this soil and on adjoining soils. Conservation tillage, which leaves crop residue on the surface throughout the year, and cover crops help reduce soil loss. The soil warms quickly in spring, thus stimulating early vegetative growth, particularly on south-facing slopes. Returning crop residue to the soil or regularly adding other organic material increases fertility, improves tilth, and increases the available water capacity.

The use of this soil for pasture or hay also effectively controls erosion. Overgrazing or grazing when the soil is too dry reduces the vegetative cover and causes deterioration of the plant community. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and some areas remain in hardwoods. Natural and planted seedlings do not survive well. Seedlings can be planted closer together. The surviving trees can be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no other hazards in planting or harvesting trees.

This soil is in capability subclass IVs.

63D—Chelsea loamy fine sand, 9 to 16 percent slopes. This is a strongly sloping and moderately steep, excessively drained soil on the uplands. It is on moundlike ridges and convex side slopes that typically blend with the landscape and generally are adjacent to stream valleys. This soil also is in isolated areas on the uplands and strongly sloping and moderately steep escarpments on alluvial terraces. Individual areas range from irregular to round in shape and from 3 to 20 acres in size.

Typically, the surface layer is dark brown and brown, very friable loamy fine sand about 5 inches thick. The subsurface layer is brown and yellowish brown, very friable loamy fine sand about 25 inches thick. The next layer, to a depth of about 60 inches, is light yellowish brown, loose fine sand that has bands of brown sandy loam 1/4 inch to 2 inches thick.

Included with this soil in mapping are small scattered areas where bedrock is exposed at the surface. The included areas make up less than 5 percent of this map unit.

Permeability of this Chelsea soil is rapid, and surface runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is less than 0.5 percent. Typically, reaction in the surface layer and the upper part of the subsurface layer varies widely as a result of local liming practices. The lower part of the subsurface layer is generally strongly acid. The subsurface layer generally is very low in available phosphorus and potassium. The surface layer is very friable and is easily tilled throughout a wide range of moisture content. This soil seldom crusts after hard rains.

Most areas of this soil are in hay or pasture. Some small areas are used for crops with larger areas of soils that are better suited to row crops than the Chelsea soil. This soil is not suited to cultivated crops because erosion is a severe hazard. The soil is better suited to grasses or deep-rooted legumes for hay or pasture. Droughtiness is a severe hazard in most years unless rainfall is timely.

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

This soil is suited to trees, and some areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. The slope is steep enough that the operation of equipment is hazardous. Special equipment can be used, but with caution. Seedlings do not survive well. They can be planted closer together to achieve the desired stand density. Plant competition is generally not a problem.

This soil is in capability subclass VIs.

63F—Chelsea loamy fine sand, 18 to 25 percent slopes. This is a steep, excessively drained soil on the uplands. It is on convex side slopes that typically blend with the landscape and generally are adjacent to stream valleys. This soil is also on steep escarpments on alluvial terraces. Individual areas are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is very dark gray, very friable loamy fine sand about 4 inches thick. The subsurface layer is about 33 inches thick. The upper part is brown loamy fine sand, and the lower part is brown, loose fine sand. Below that, to a depth of about 50 inches, there is brown, loose fine sand that has bands of brown loamy fine sand 1/4 inch to 2 inches thick.

Included with this soil in mapping are small areas where bedrock is exposed at the surface. These areas are on the lower part of side slopes and are lower in organic matter content than the Chelsea soil. The included areas make up less than 5 percent of this map unit.

Permeability of this Chelsea soil is rapid, and surface runoff is rapid. The available water capacity is low. The content of organic matter in the surface layer is less than 0.5 percent. Typically, reaction in the surface layer and the upper part of the subsurface layer varies widely as a result of local liming practices. The lower part of the subsurface layer is generally strongly acid. The subsurface layer generally is very low in available phosphorus and potassium. The surface layer is very friable and is easily tilled throughout a wide range of moisture content. This soil seldom crusts after hard rains.

Most areas of this soil are used as woodland or pasture. This soil is not suited to cultivated crops or to hay. It is better suited to grasses and deep-rooted legumes for pasture. Ordinary farm machinery cannot be used on this soil because of the steep slopes. If it is not protected by vegetation, this soil is subject to wind and water erosion. Blowing sand from this soil can damage newly seeded crops on adjoining soils. This soil is very droughty, and if it is used for pasture, production will be low unless rainfall is above normal and timely. Returning crop residue to the soil or regularly adding other organic materials improves soil fertility and tilth and stabilizes sand blowouts.

The use of this soil for pasture is effective in controlling erosion. In many of the steepest areas where it is not possible to apply fertilizer and lime, pasture yields are very low. Proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and soil in good condition.

This soil is suited to trees, and most areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. Because the soil is steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Seedlings do not survive well. They can be planted closer together to achieve the desired stand density. Plant competition is generally not a problem.

This soil is in capability subclass VIIs.

65E2—Lindley loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, well drained soil on short, convex side slopes on the uplands. Individual areas are narrow and irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. It has pockets of yellowish brown, firm loam, which is subsoil material that has been mixed into the surface layer by plowing. The subsoil is about 42 inches thick. The upper part is brown, friable loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown and dark yellowish brown, firm clay loam and loam with strong brown and pale brown mottles. The substratum to a depth of about 60 inches is mottled pale brown, very pale brown, and yellowish brown, firm silt loam. In some areas, the surface layer is very dark grayish brown and is more than 7 inches thick.

Included with this soil in mapping are a few small areas of reddish clay or clay loam paleosol soils that formed in glacial till. The soils are somewhat poorly drained, are wet and seepy, and are on high shoulder positions on the landscape. In some areas, the surface layer is yellowish brown, firm clay loam. In these areas, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. The included soils make up less than 5 percent of this map unit.

Permeability of this Lindley soil is moderately slow. Surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Lindley soils. The content of organic matter in the surface layer is less than 0.5 percent. Typically, the surface layer is medium acid or slightly acid, and lime is needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally is medium in available phosphorus and very low in available potassium. This soil has poor tilth. It puddles if worked when it is wet and crusts after hard rains. The crust increases runoff and retards plant growth on this soil.

Most areas of this soil are in hay and pasture. This soil is generally not suited to row crops such as corn and soybeans. It is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. This soil is poorly suited to terracing because of the short, moderately steep slopes. Cultivated crops should be grown only to reestablish seeding. Larger amounts of fertilizer are needed on this soil than on uneroded Lindley soils.

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

This soil is suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour reduces soil erosion. The slope is steep enough that the operation of equipment is hazardous. Special equipment can be used, but with caution. Seedlings do not survive well. They can be

planted closer together to achieve the desired stand density. Plant competition is generally not a problem.
This soil is in capability subclass VIe.

65F—Lindley loam, 18 to 30 percent slopes. This is a steep, well drained soil on short, convex side slopes on the uplands. Individual areas are narrow and irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown and dark yellowish brown, firm clay loam and loam with strong brown and pale brown mottles. The substratum to a depth of about 60 inches is mottled pale brown, very pale brown, and yellowish brown, firm loam. In cultivated areas, the surface layer is thinner than is typical and is mixed with pockets of yellowish brown, firm clay loam.

Included with this soil in mapping are a few small areas of a soil with coarse gravel on the surface. These areas, on the lower part of side slopes, are droughty and difficult to till. In some areas, the surface layer is yellowish brown, firm clay loam. In these areas, the organic matter content is low, tilth is poor, and larger amounts of fertilizer are required. The included soils make up less than 5 percent of this map unit.

Permeability of this Lindley soil is moderately slow. Surface runoff is rapid. The available water capacity is moderate to high. The content of organic matter in the surface layer is 0.5 to 1 percent. Typically, the surface layer is medium acid or slightly acid. The subsoil is medium acid or strongly acid. The subsoil generally is medium in available phosphorus and very low in available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after heavy rains. The crust increases runoff and retards plant growth on this soil.

Most areas of this soil are now in permanent pasture. This soil is not suited to row crops because erosion is a severe hazard. In places, the slope is too steep for the use of ordinary farm machinery. This soil is too steep for terraces. Furthermore, because of low fertility and a high density subsoil, it is not well suited to terraces. Revegetation is difficult where the subsoil is exposed.

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

This soil is suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. Because the soil is steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Seedlings do not survive well. They can be planted closer together to achieve the desired stand density. Plant competition is generally not a problem.

This soil is in capability subclass VIIe.

83B—Kenyon loam, 2 to 5 percent slopes. This is a gently sloping, moderately well drained soil on long, convex ridgetops and side slopes on 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, friable loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 44 inches thick. The upper part is brown, dark brown, and dark yellowish brown, friable loam; the middle part is dark yellowish brown and yellowish brown, friable loam with yellowish brown mottles; and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some small areas the surface layer is thinner and lighter colored than is typical.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd soils. These areas, along upland drainageways, need to be drained; otherwise, they could delay field operations. These areas make up less than 5 percent of this map unit.

Permeability of this Kenyon soil is moderate, but this soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and in the substratum. Surface runoff is medium. The available water capacity is high. The firm glacial till in the lower part of the subsoil tends to perch water, resulting in wet seepy areas at the base of side slopes. Typically, a stone line separates the loamy material and the underlying glacial till. The content of organic matter in the surface layer is about 3 to 4 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. The soil is neutral or slightly acid to a depth of about 20 inches; it is medium acid or strongly acid at a depth of about 33 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer has good tilth, but it tends to puddle if tilled when it is wet.

Most areas of this soil are cultivated. This soil is well suited to intensive row crop production of corn and soybeans. This soil is also well suited to small grains and grasses or legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, a practice that leaves crop residue on the surface throughout the year, help reduce soil loss. In many areas, the slopes are long and smooth enough to permit terracing and contour farming. If terraces are used, cuts should be held to a minimum to avoid unnecessary exposure of the underlying glacial till, which is low in fertility. Stones from the subsoil can interfere with tillage. Because permeability in the loamy overburden and in the glacial till are relatively different, water tends to accumulate at the glacial till contact. The water moves laterally and creates wet seepy areas in some years. Because this soil is seasonally wet and subject to erosion, a combination of terracing and tile drainage is beneficial in some areas. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is in capability subclass IIe.

83C—Kenyon loam, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on convex ridges and side slopes on uplands. Individual areas are commonly irregular bands that range from 5 to 20 acres in size.

Typically, in cultivated areas, the surface layer is very dark brown, friable loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 3 inches thick. The subsoil is about 40 inches thick. The upper part is brown, dark brown, and dark yellowish brown, friable loam, and the lower part is yellowish brown, firm loam with grayish brown mottles. The substratum to a depth of about 60 inches is mottled brown and yellowish brown loam. In some small areas, the surface layer is thinner and lighter colored than is typical.

Permeability of this Kenyon soil is moderate, but this soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and in the substratum. Surface runoff is medium. The available water capacity is high. The firm glacial till in the lower part of the subsoil tends to perch water, resulting in wet seepy areas at the base of side slopes. Typically, a stone line separates the glacial till and the loamy material above it. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. The soil generally is neutral or slightly acid to a depth of about 16 inches; it is medium acid or strongly acid at a depth of about 29 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer has good tilth, but it tends to puddle if tilled when it is wet.

Most areas of this soil are cultivated. This soil is moderately well suited to row crops, such as corn and soybeans. It is well suited to small grains and grasses or legumes for hay or pasture. If this soil is used for cultivated crops, erosion is a moderate or severe hazard. Terraces, stripcropping, and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce excessive soil loss. Because permeability in the loamy overburden and in the glacial till are relatively different, water tends to accumulate at the glacial till contact. The water moves laterally and creates wet seepy areas in some years. Because this soil is seasonally wet and subject to erosion, a combination of terracing and tile drainage is beneficial in some areas. If terraces are constructed, cuts should be kept to a minimum to avoid unnecessary exposure of the underlying glacial till, which is low in fertility. Stones from the subsoil can interfere with tillage. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and improves water infiltration.

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

This soil is in capability subclass IIIe.

84—Clyde loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil along drainageways and in lower concave positions on uplands. Individual areas are irregular in shape and generally are elongated. They range from 10 to more than 80 acres in size.

Typically, the surface layer is black, friable loam about 7 inches thick. The subsurface layer is black and dark gray, friable loam about 15 inches thick. The subsoil is about 31 inches thick. The upper part is grayish brown, friable loam with light olive brown mottles, and the lower part is grayish brown and yellowish brown, firm loam. The substratum to a depth of about 60 inches is gray loam with brownish yellow mottles. In small areas along the lower part of drainageways, sand and gravel are at a depth of more than 3 feet.

Included with this soil in mapping are small areas of somewhat poorly drained Floyd and Schley soils. Floyd and Schley soils are on the higher part of foot slopes. They are lower in content of organic matter than the Clyde soil. Schley soils are more acid in the subsoil. The included soils make up about 5 to 10 percent of this map unit.

Permeability of this Clyde soil is moderate, but this soil is more permeable in the upper part of the subsoil than the lower part of the subsoil and the substratum. Surface runoff is slow. This soil has a seasonal high water table at a depth of 1 foot to 2.5 feet. The available water capacity is high. The content of organic matter in the surface layer ranges from about 9 to 11 percent. Typically, the surface and subsurface layers are neutral or slightly acid. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer has fair tilth. It puddles if tilled when it is wet.

Most areas of this soil are cultivated. This soil is well suited to intensive row crop production of corn and soybeans. This soil is also well suited to small grains and grasses or legumes for hay or pasture if it is artificially drained and protected from surface runoff from the higher elevations. Wind erosion is a hazard in cultivated areas if the soil is plowed in the fall and not protected. Conservation tillage, which leaves crop residue on the surface throughout the year, and grassed waterways help reduce soil loss. Where row crops are grown, artificial drainage is needed to lower the water table, thus improving conditions for field operations. Glacial stones and boulders are common in many unimproved and undrained areas, and they need to be removed before the soil can be tile drained and cultivated. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is in capability subclass IIw.

97—Lawson-Huntsville silt loams, 0 to 2 percent slopes. These are nearly level soils on wide bottom lands along small streams. The somewhat poorly drained Lawson soil is occasionally flooded, and the moderately well drained Huntsville soil is rarely flooded. Areas of the Lawson and Huntsville soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas consist of about 65 percent Lawson soil at the lower elevations and about 30 percent Huntsville soil in higher, convex positions. Individual areas are broad and irregular in shape and range from 10 to 50 acres in size.

Typically, the Lawson soil has a surface layer that is black and very dark gray, friable silt loam about 10 inches thick. The subsurface layer is black and very dark grayish brown, friable silt loam about 21 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown silt loam with yellowish brown and strong brown mottles.

Typically, the Huntsville soil has a surface layer that is black, friable silt loam about 10 inches thick. The subsurface layer is black and very dark grayish brown, friable silt loam about 28 inches thick. The substratum to a depth of about 60 inches is dark brown and brown loam and has brown sandy loam strata in the lower part.

Included with these soils in mapping are a few small areas of Coppock soils. Coppock soils are in shallow swales and along drainageways and may pond water for short periods. These soils make up less than 5 percent of the map unit.

Permeability of the Lawson and Huntsville soils is moderate. Surface runoff is slow. The available water capacity is high. The Lawson soil has a seasonal high water table at a depth of 1 foot to 3 feet. The content of organic matter in the surface layer of the Lawson soil is about 4.5 to 6 percent, and in the Huntsville soil it is about 3 to 4 percent. Typically, reaction in the surface layer of both soils is neutral or slightly acid. Generally, the subsoil of the Lawson soil is low in available phosphorus, and the subsoil of the Huntsville soil is medium. Both soils have a very low supply of potassium. These soils have good tilth, but they tend to puddle if worked when they are wet.

Most areas of these soils are cultivated. A few areas are in pasture. These soils are well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture, if they are protected from flooding. Diversion terraces on adjacent sloping soils upslope may be needed in some areas to protect crops from local runoff. Because of the seasonal high water table in the Lawson soil, tile drainage may be needed to allow timely field operations.

These soils are well suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

These soils are moderately suited to trees. Tree plantings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled by site preparation and by removal of undesirable species. The choice of species and the use of equipment are limited by the wetness of the soil and occasional flooding.

The soils in this complex are in capability subclass IIw.

109C—Backbone fine sandy loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat excessively drained soil on convex ridges and side slopes. Individual areas are elongated and range from 5 to 10 acres in size.

Typically, the surface layer is dark brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is brown, very friable sandy loam; the middle part is dark yellowish brown, friable fine sandy loam; and the lower part is dark yellowish brown, friable clay loam. The subsoil is underlain at a depth of about 26 inches by hard, fractured limestone. In cultivated areas, the surface layer is thinner than is typical and has pockets of yellowish brown, firm clay loam.

Permeability of this Backbone soil is moderately rapid in the upper part and moderately slow in the lower part.

Surface runoff is medium. The available water capacity is low. The content or organic matter in the surface layer is about 1 to 2 percent. The surface layer typically is medium acid to neutral. The subsoil generally is neutral or medium acid. The subsoil generally has a low supply of available phosphorus and potassium. This soil has fair tilth. It tends to crust after hard rains.

Most areas of this soil are in pasture. A few areas are in cultivated crops or trees. This soil is poorly suited to cultivated crops because it is droughty and subject to erosion. Cultivated crops typically are grown only for 1 year to reestablish meadow after previous seedings have been depleted. The root zone is limited, and tillage can be difficult because of shallowness to limestone. If the soil is used for cultivated crops, erosion is a hazard. Conservation tillage, which leaves crop residue on the surface throughout the year, can control runoff and reduce moisture losses and helps reduce wind and water erosion. Returning crop residue to the soil or regularly adding other organic material imcreases fertility and water infiltration.

The use of this soil for pasture or hay is effective in controlling erosion; however, overgrazing can increase wind and water erosion. Proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. There should be no problems in planting new stands of trees if proper species are selected and managed properly.

This soil is in capability subclass IVs.

109D—Backbone fine sandy loam, 9 to 14 percent slopes. This is a strongly sloping, somewhat excessively drained soil on convex side slopes. Individual areas are elongated and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown and dark brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 15 inches thick. The upper part is brown, very friable fine sandy loam; the middle part is dark yellowish brown, friable sandy loam; and the lower part is dark yellowish brown and yellowish brown, friable sandy clay loam. The subsoil is underlain at a depth of about 22 inches by hard, fractured limestone.

Included with this soil in mapping are small areas of limestone bedrock outcrops. These included areas make up less than 5 percent of this map unit.

Permeability of this Backbone soil is moderately rapid in the upper part and moderately slow in the lower part. Surface runoff is moderately rapid. The available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. The surface layer typically is medium acid to neutral. The subsurface layer and subsoil generally are neutral to medium acid. The subsoil generally has a low supply of available phosphorus and potassium. This soil has fair tilth. It tends to crust after hard rains.

Most areas of this soil are in pasture or trees. This soil is not suited to cultivated crops because it is subject to severe erosion. Furthermore, the soil is droughty.

Even though yields and the carrying capacity of this soil are low, the use of this soil for pasture or hay is effective in controlling erosion. Overgrazing, however, can increase wind and water erosion. Proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, help to keep the pasture and soil in good condition.

This soil is well suited to trees, and many small areas remain in native hardwoods. There should be no problems in planting new stands of trees if proper species are selected and managed properly.

This soil is in capability subclass VIs.

110B—Lamont fine sandy loam, 2 to 5 percent slopes. This is a gently sloping, well drained soil on convex side slopes on stream terraces and uplands. The soil generally is adjacent to stream valleys. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is very dark gray, friable fine sandy loam about 4 inches thick. The subsurface layer is dark grayish brown and brown, friable fine sandy loam about 5 inches thick. The subsoil is brown, yellowish brown, and dark yellowish brown, friable and very friable fine sandy loam about 27 inches thick. The substratum to a depth of about 60 inches is yellowish brown and brownish yellow, loose loamy sand.

Included with this soil in mapping are some small areas of excessively drained Chelsea soils on escarpments and on slightly higher knolls. These areas are slightly lower in organic matter content and available water capacity than the Lamont soil, and they are more susceptible to soil blowing. Also included on upland shoulders are a few small areas where mottled, firm glacial till is at a depth of 40 to 60 inches. These areas can cause sidehill seeps at the base of slopes. The included areas make up 5 to 10 percent of this map unit.

Permeability of this Lamont soil is moderately rapid. Surface runoff is medium. The available water capacity is moderate. The organic matter content in the surface layer is about 0.5 to 1 percent. Reaction is medium acid to strongly acid in the subsoil, but reaction is variable in the surface layer as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content. This soil may crust after hard rains.

Most areas of this soil are cultivated or are in pasture. Many small areas of this soil are used for crops with large areas of soils that are better suited to crops than the Lamont soil. This soil is suited to row crop production of corn and soybeans. It is also suited to small grains and grasses or legumes for hay and pasture. Wind erosion is a hazard in cultivated areas. Initial wind erosion occurs on rounded, convex shoulder slopes. Blowing sand grains sometimes damage newly seeded crops on this soil and on adjoining soils if there is no vegetation on the soil. Conservation tillage, which leaves crop residue on the surface, contour stripcropping, and terraces help reduce soil loss. This soil is not well suited to terraces because the moderately coarse textured material is difficult to maintain as a terraced ridge. Also, the soil is shallow to underlying coarse textured material. If terraces are used, the coarse textured material in the terrace channel should not be exposed. Droughtiness is a hazard in most years unless rainfall is timely. This soil warms quickly in spring, thus stimulating early vegetative growth, particularly on south- and east-facing slopes. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases the available water capacity.

The use of this soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is too dry reduces the protective vegetative cover and causes deterioration of the plant community. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or harvesting trees.

This soil is in capability subclass IIIe.

110C—Lamont fine sandy loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on convex ridges and side slopes on stream terraces and uplands. The soil generally is adjacent to stream valleys. Individual areas of this soil are irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable fine sandy loam about 7 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is yellowish brown and dark yellowish brown, friable and very friable sandy loam about 24 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand; it has nearly horizontal strong brown layers of very friable loamy sand 1/4 inch to 2 inches thick.

Included with this soil in mapping are some small areas of excessively drained Chelsea soils on escarpments and on slightly higher knolls. The areas are slightly lower in organic matter content and available water capacity than the Lamont soil, and they are more susceptible to soil blowing. Also included on upland shoulders are a few small areas where mottled, firm glacial till is at a depth of 40 to 60 inches. These areas can cause sidehill seeps at the base of slopes. The included areas make up 5 to 10 percent of this map unit.

Permeability of this Lamont soil is moderately rapid. Surface runoff is medium. The available water capacity is moderate. The organic matter content in the surface layer is less than 0.5 percent. Reaction is medium acid and strongly acid in the subsoil, but reaction varies in the surface layer as a result of local liming practices. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content. This soil may crust after hard rains.

Most areas of this soil are cultivated or are in pasture. Many small areas of this soil are used for crops with large areas of soils that are better suited to crops than the Lamont soil. This soil is suited to row crops, such as corn and soybeans. It is also suited to small grains and grasses or legumes for hay and pasture. Wind erosion is a hazard in cultivated areas. Initial wind erosion occurs on rounded, convex shoulder slopes. Blowing sand grains sometimes damage newly seeded crops on this soil and on adjoining soils if there is no vegetation on the soil. Conservation tillage, which leaves crop residue on the surface, contour stripcropping, and terraces help reduce excessive soil loss. Grassed waterways help prevent gully erosion. This soil is not well suited to terraces because the moderately coarse textured material is difficult to maintain as a terrace ridge. Also, the soil is shallow to underlying coarse textured material. If terraces are used, the coarse textured material in the terrace channel should not be exposed. Droughtiness is a hazard in most years unless rainfall is timely. This soil warms quickly in spring, thus stimulating early vegetative growth, particularly on south- and east-facing slopes.

Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases the available water capacity.

The use of this soil for pasture or hay is also effective in controlling erosion. Overgrazing or grazing when the soil is too dry reduces the protective vegetative cover and causes deterioration of the plant community. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help keep the pasture and soil in good condition.

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or havesting trees.

This soil is in capability subclass IIIe.

110D—Lamont fine sandy loam, 9 to 14 percent slopes. This is a strongly sloping, well drained soil on uplands and on terraces along streams. It is on convex ridges and side slopes. Individual areas are oblong and irregular in shape and are generally 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable fine sandy loam about 5 inches thick. The subsurface layer is dark grayish brown, fraible fine sandy loam about 4 inches thick. The subsoil is about 21 inches thick. The upper part is brown, very friable fine sandy loam; the middle part is brown, very friable sandy loam; and the lower part is dark yellowish brown, very friable sandy loam. The substratum to a depth of 60 inches is yellowish brown loamy sand with thin bands of brown sandy loam. In cultivated areas, the surface and subsurface layers have been mixed into the plow layer.

Included with this soil in mapping are a few small scattered areas of Chelsea and Fayette soils. Chelsea soils are on slightly higher knolls. They have less clay than the Lamont soil and are more droughty. Fayette soils generally are in slightly lower positions. They have more clay than the Lamont soil and are more productive. The included soils make up 5 to 10 percent of the map unit.

This Lamont soil has moderately rapid permeability. Surface runoff is medium. The available water capacity is medium. The organic matter content is less than 0.5 percent in the surface layer. This soil generally is neutral to slightly acid in the surface layer and medium acid to strongly acid in the subsoil. The need for lime in the surface layer varies according to previous liming practices. This soil needs lime if it has not been applied in the past 3 or 4 years. The subsoil is generally medium in available phosphorus and very low in available potassium. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content. This soil may crust after hard rains.

Most areas of this soil are in cultivated crops, hay, or pasture. This soil is poorly suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to wind and water erosion. This soil is droughty, and all crop yields are dependent on the amount and timeliness of rainfall. Conservation tillage, which leaves crop residue on the surface, reduces soil erosion. Returning crop residue to the soil or regularly adding other organic material to the plow layer increases fertility.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or harvesting trees.

This soil is in capability subclass IVe.

119—Muscatine silt loam, 1 to 3 percent slopes. This is a very gently sloping, somewhat poorly drained soil on broad divides and convex side slopes above drainageways on the uplands. Individual areas are smooth and irregular in shape and range from 10 to 30 acres in size.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. The subsurface layer is very dark brown, friable silty clay loam about 10 inches thick. The subsoil is 30 inches thick. The upper part is dark grayish brown, friable silty clay loam with dark brown coatings; the middle part is grayish brown, friable silty clay loam with yellowish brown mottles; and the lower part is grayish brown, friable silty clay loam with yellowish brown mottles. The substratum to a depth of about 60 inches is grayish brown silt loam with yellowish brown mottles. In some small areas, the surface layer is light colored and is thinner than is typical.

Permeability of this Muscatine soil is moderate, and surface runoff is slow. This soil has a seasonal high water table at a depth of 2 to 4 feet. The available water capacity is high to very high. The content of organic matter in the surface layer is about 4 to 6 percent. Typically, the surface layer is neutral to slightly acid. The need for lime in the surface layer varies according to previous liming practices, and generally lime is needed if it has not been applied in the past 3 to 5 years. The subsoil is slightly acid to medium acid. The subsoil generally is low in available phosphorus and very low in available potassium. This soil has good tilth. It tends to puddle if tilled when it is wet.

Most areas of this soil are used for cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil can be used for intensive row cropping. Because of the seasonal high water table, however, the soil tends to puddle if worked when wet. The use of subsurface drains improves the timeliness of field operations in wet years. Returning crop residue to the soil or regularly adding other organic material increases 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, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is in capability class I.

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

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 31 inches thick. The upper part is brown and very dark grayish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silty clay loam with grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown mottles.

Permeability of this Tama soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. Typically, the surface layer is slightly acid, and generally lime is needed if it has not been applied in the past 3 to 5 years. The subsurface layer and the upper part of the subsoil are medium acid to strongly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil can be used intensively for row crops if erosion is controlled. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and smooth enough to permit terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is in capability subclass IIe.

120C—Tama silt loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on ridges and side slopes on uplands. Individual areas are irregular in shape and range from 50 to more than 100 acres in size.

Typically, the surface layer is very dark brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and dark yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown mottles. In some cultivated areas, the combined thickness of the surface and subsurface layers is as thin as 7 inches.

Permeability of this Tama soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 3 to 4 percent. Typically, the surface layer is slightly acid, and generally lime is needed if it has not been applied in the past 3 to 5 years. The subsurface layer and subsoil are medium acid to strongly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops or hay. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated areas. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and smooth enough to permit terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is in capability subclass IIIe.

120C2—Tama silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, well drained soil on the uplands. It is on convex, narrow ridges and side slopes. Individual areas are long and irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. It has pockets of brown, friable, silty clay loam subsoil material. The subsoil is about 29 inches thick. The upper part of the subsoil is dark yellowish brown, friable silty clay loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with grayish brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown mottles.

Included with this soil in mapping are areas of a soil that has a surface layer of yellowish brown silty clay loam. The soil is on the upper part of side slopes. It is low in organic matter content, has poor tilth, and requires large amounts of fertilizer because it is mostly subsoil material that has been mixed into the plow layer. These included areas make up less than 5 percent of the map unit.

Permeability of this Tama soil is moderate. Surface runoff is moderate, but there is more runoff and less infiltration of water on this soil than on the uneroded Tama soils. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is slightly acid. The need for lime in the surface layer varies according to previous liming practices, but generally lime is needed if it has not been applied in the past 3 to 5 years. The subsurface layer and subsoil are medium acid to strongly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil generally has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops or hay. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. In cultivated areas, this soil is subject to further erosion. This soil puddles if worked when it is wet. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and smooth enough to permit terracing and contour farming. More fertilizer is needed on this soil than on the uneroded Tama soils. Returning crop residue to the soil or regularly adding other organic material increases fertility and the infiltration of water.

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

This soil is in capability subclass IIIe.

129B—Chaseburg-Arenzville silt loams, 0 to 5 percent slopes. These soils are gently sloping and moderately well drained. They are along narrow upland drainageways that are U-shaped and generally 50 to 200 feet wide. These soils are subject to flooding. They are associated with the more sloping, loess covered soils on uplands.

The Chaseburg soil is on foot slopes and along the upper part of drainageways, and the Arenzville soil is along drainageways and on the lower part of side slopes. The Chaseburg and Arenzville soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 50 percent Chaseburg soil and 40 percent Arenzville soil. Individual areas are long and irregular in shape; some are more than 1 mile long. The areas range from 30 to 70 acres in size.

Typically, the Chaseburg soil has a surface layer that is dark grayish brown and dark yellowish brown, friable silt loam about 7 inches thick. The underlying material is stratified dark grayish brown and grayish brown silt loam about 53 inches thick.

Typically, the Arenzville soil has a surface layer that is very dark grayish brown and dark grayish brown, friable silt loam about 7 inches thick. The next layer is stratified dark grayish brown, grayish brown, and light brownish gray, friable silt loam about 20 inches thick; it has dark brown mottles in the lower part. The underlying material is a buried surface layer of black silt loam. It has been buried by recent stratified sediment. The substratum to a depth of about 60 inches is dark gray silt loam with olive and olive brown mottles.

Included with these soils in mapping are small areas of Orion soils. Orion soils are near the center of the upper part of drainageways and are somewhat poorly drained to poorly drained. The included soils make up about 10 percent of this map unit.

Permeability of the Chaseburg and Arenzville soils is moderate. Surface runoff is slow. These soils have a seasonal high water table at a depth of 3 to 6 feet. The available water capacity is high to very high. The content or organic matter in the surface layer is about 0.5 to 1 percent. Typically, the soils are neutral or slightly acid throughout. The subsoil generally is low in available phosphorus and very low in available potassium. These soils have fair tilth. They tend to crust after heavy rains and to puddle if worked when they are wet.

Most areas of these soils are in pasture or are cultivated with the surrounding upland soils. Individual areas are generally too small to be cropped separately. If they are protected from overflows, the soils are moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The soils are susceptible to high velocity, concentrated runoff from the adjoining, more sloping soils on uplands. They can be protected from excess water by terraces constructed on the adjoining upland side slopes. In some areas, seepage from upland slopes tends to make these soils seasonably wet. Tile may be needed in these areas to permit timely field operations. Erosion control structures may be needed in some areas to control the formation of gullies.

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

These soils are suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

These soils are in capability subclass IIe.

142—Chaseburg silt loam, 0 to 2 percent slopes. This is a nearly level, moderately well drained soil on bottom lands below the more sloping, loess-covered soils on uplands. This soil is subject to occasional flooding. Individual areas are elongated in shape; some are several miles long. The areas generally are 100 to 150 acres in size.

Typically, the surface layer is dark grayish brown and dark yellowish brown, friable silt loam about 7 inches thick. The next layer, to a depth of about 60 inches, is stratified dark grayish brown and grayish brown, friable silt loam. It formed in recently deposited sediment. In some small areas, a very dark gray, silt loam buried surface layer is within a depth of 40 inches.

Permeability of this Chaseburg soil is moderate, and surface runoff is slow. This soil has a seasonal high water table at a depth of 3 to 6 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, reaction is neutral to slightly acid throughout the soil. Applications of lime generally are not needed on this soil. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to crust after hard rains and to puddle if worked when it is wet.

Most areas of this soil are in hay, pasture, or cultivated crops. This soil is well suited to corn, soybeans, and small grains if it is protected from flooding, or in any year in which it is not subject to flooding. It is also well suited to grasses for hay and pasture. In areas where silt does not accumulate, the soil is suited to legumes for hay and pasture. This soil is subject to flooding during periods of heavy rain. Crops are damaged by floods in some years. Flooding leaves the soil wet for an extended period and delays tillage. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIw.

152—Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on terraces along streams and drainageways that are filled with outwash sediment. This soil is occationally flooded. Individual areas are long and irregular in shape and range from 10 to 30 acres in size.

Typically, the surface layer is black, friable loam about 10 inches thick. The subsurface layer is black, friable loam and clay loam about 13 inches thick. The subsoil is about 12 inches thick. The upper part is dark gray, firm clay loam, and the lower part is gray, friable loam with light olive brown mottles. The substratum to a depth of about 60 inches is grayish brown, very friable and loose sandy loam and coarse sand. In some small areas in the upper part of drainageways, glacial till is at a depth of about 2 or 3 feet.

Included with this soil in mapping are a few small areas of somewhat poorly drained Hayfield soils. The Hayfield soils are on slightly higher positions on the landscape, have less organic matter, and are not so wet as the Marshan soil. These included soils make up less than 5 percent of this map unit.

Permeability of this Marshan soil is moderate in the loamy material and rapid in the underlying sand and gravel. Surface runoff is slow. This soil has a seasonal high water table at a depth of 1 foot to 2.5 feet. The available water capacity is moderate. The content of organic matter in the surface layer is about 5 to 6 percent. Generally, the surface layer and subsoil are neutral or slightly acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses for hay and pasture. In order to grow row crops, artificial drainage is needed to lower the water table and to improve the timeliness of field operations. Adequate outlets for drains are difficult to establish in some places. Subsurface drains can be difficult to install and maintain because of the loose, water-bearing sand and gravel at a depth of 3 feet. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains tilth.

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

This soil is in capability subclass IIw.

158—Dorchester silt loam, 0 to 2 percent slopes. This is a nearly level, moderately well drained soil on wide bottom lands below the more sloping, loess-covered soils on uplands. This soil is occasionally flooded. Individual areas are elongated and may extend for several miles in length. The areas range from 100 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. It has strata that are very dark grayish brown. The next layer is a stratified substratum of dark grayish brown, very dark grayish brown, and brown, friable silt loam about 22 inches thick with grayish brown mottles in the lower part. The substratum formed in recently deposited sediment. The underlying material to a depth of about 60 inches is a buried surface layer of black silt loam with yellowish brown mottles in the upper part.

Permeability of this Dorchester soil is moderate, and surface runoff is slow. The available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the recent stratified sediment is mildly alkaline or moderately alkaline. The buried surface layer is neutral or mildly alkaline. The substratum generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil along the narrow valleys are in pasture, but the broader areas along rivers are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture if it is protected from flooding. The occasional floods are of short duration. Yields may vary considerably from year to year, depending on the flooding. In some areas, diversion terraces may be needed upslope on adjacent soils to prevent crops from being covered by recent sediment. The need for flood protection varies in each area because the deepening and straightening of stream channels and road construction can reduce the hazard of flooding.

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

This soil is suited to trees, but trees are mostly in groves and around farmsteads. Natural and planted seedlings do not survive well. They can be planted close together and thinned later to achieve the desired stand density. Competing vegetation can be controlled by site preparation or by spraying or cutting. There are no other hazards in planting or harvesting trees.

This soil is in capability subclass IIw.

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

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil, to a depth of about 60 inches, is brown, friable silty clay loam in the upper part and yellowish brown, friable silt loam with strong brown and pale brown mottles in the lower part.

Permeability of this Downs soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is neutral or slightly acid if lime has not been applied in the past 3 or 4 years. The subsoil is slightly acid or medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil is suited to intensive use for row crops if it is well managed, but erosion is a hazard. Contour stripcropping or conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and smooth enough to permit terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is well suited to trees. Natural and planted seedlings survive and grow if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girding. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIe.

162C—Downs silt loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on convex ridges and side slopes in the uplands. Individual areas are narrow and irregular in shape and range from 50 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsoil, to a depth of about 60 inches, is brown, friable silt loam in the upper part; yellowish brown, friable silty clay loam in the middle part; and yellowish brown, friable silt loam with strong brown and pale brown mottles in the lower part.

Permeability of this Downs soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is neutral or slightly acid if lime has not been applied in the past 3 or 4 years. The subsoil is slightly acid or medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops in rotation with hay. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas the slope is long and smooth enough to permit terracing and contour farming. Returning crop residue to the soil adding other organic material increases fertility and improves soil tilth.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

162C2—Downs silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, well drained soil on convex ridges and side slopes in the uplands. Individual areas are narrow and irregular in shape and range from 50 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. There are pockets of brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 49 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and strong brown mottles.

Included with this soil in mapping are areas of a soil on the upper part of side slopes that has a surface layer of yellowish brown silty clay loam. In these areas, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. These included areas make up less than 5 percent of the map unit.

Permeability of this Downs soil is moderate, and surface runoff is medium. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Downs soils. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is neutral or slightly acid if lime has not been applied in the past 3 or 4 years. The subsoil is slightly acid or medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to further erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas the slope is long and smooth enough to permit terracing and contour farming. More fertilizer is needed on this soil than on the uneroded Downs soils. Returning crop residue to the soil or regularly adding other organic material increases fertility and the infiltration of water and improves soil tilth.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

162D—Downs silt loam, 9 to 14 percent slopes. This is a strongly sloping, well drained soil on convex side slopes in the uplands. Individual areas are irregular in shape and range from 20 to 70 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 48 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark yellowish brown and yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and strong brown mottles.

Permeability of this Downs soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is slightly acid if lime has not been applied in the past 3 or 4 years. The subsoil is slightly acid to strongly acid. It generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops in rotation with hay. This soil is moderately well suited to corn and small grains but is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping or conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and smooth enough to permit terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is well suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

162D2—Downs silt loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, well drained soil on convex side slopes in the uplands. Individual areas are irregular in shape and range from 50 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. There are pockets of brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 46 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable silt loam; the middle part is dark yellowish brown and yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and strong brown mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Because the Lindley soils formed in glacial till, the surrounding Downs soils are seepy during wet periods. The Lindley soils are low in fertility. Also included are a few small areas of limestone rock outcrops in high shoulder positions on the landscape. In some areas the surface layer is yellowish brown silty clay loam. In these areas, which are scattered throughout the map unit, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. The included soils and the areas of rock outcrops make up 5 to 10 percent of this map unit.

Permeability of this Downs soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Downs soils. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid if lime has not been applied in the past 3 to 4 years. The subsoil is slightly acid to strongly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. This soil is moderately well suited to occasional corn and small grains but is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to further erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and smooth enough to permit terracing and contour farming (fig. 9). More fertilizer is needed on this soil than on the uneroded Downs soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases the infiltration of water.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

162E2—Downs silt loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, well drained soil on convex side slopes in the uplands. Individual areas are narrow and irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. It has pockets of brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 43 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable silt loam; the middle part is dark yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with strong brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and strong brown mottles. In places the surface layer is more than 7 inches thick.

Figure 9.—Terraces on strongly sloping Downs soil are effective in controlling soil erosion. The crop is corn.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till and are low in fertility, cause the surrounding Downs soils to be seepy during wet seasons. In some areas the surface layer is yellowish brown silty clay loam. In these areas, generally on the lower part of side slopes, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. The included soils make up 5 to 10 percent of the map unit.

Permeability of this Downs soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Downs soils. The content of organic matter in the surface layer is about 1 to 1.5 percent. Typically, the surface layer is slightly acid if lime has not been applied in the past 3 or 4 years. The subsoil is slightly acid to strongly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. Some areas are also in pasture. This soil is suited to occasional crops of corn in rotation with small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to further erosion. Contour stripcropping or conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In most areas the slope is too steep and too short to permit terracing. However, terraces can be constructed in some areas where there are less sloping soils upslope. More fertilizer is needed on this soil than on uneroded Downs soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases the infiltration of water.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. Because this soil is steep, some hazard is involved in the operation of equipment. Special equipment can be used, but with caution. Survival of seedlings or competition from undesirable plants should not be a problem. To reduce further erosion, the surface should not be disturbed excessively during planting and harvesting.

This soil is in capability subclass IVe.

163B—Fayette silt loam, 2 to 5 percent slopes. This is a gently sloping, well drained soil on convex ridgetops in the uplands. Individual areas are long and irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil, to a depth of about 60 inches, is brown, friable silty clay loam in the upper part; dark yellowish brown and yellowish brown, friable silty clay loam in the middle part; and yellowish brown, friable silt loam with light brownish gray mottles in the lower part.

Included with this soil in mapping are sinkholes that are 20 to 30 feet in diameter and 10 to 20 feet deep. The sinkholes are scattered randomly 10 to 100 feet apart and occur adjacent to the Silurian limestone escarpment. In these areas, tillage and logging operations are hindered and livestock can be lost or trapped if the sinkholes are not fenced. These areas make up less than 5 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. A few areas are in pasture or remain in timber. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, which leaves crop residue on theiable silt loam with light brownish gray mottles in the lower part.

Included with this soil in mapping are sinkholes that are 20 to 30 feet in diameter and 10 to 20 feet deep. The sinkholes are scattered randomly 10 to 100 feet apart and occur adjacent to the silvrian limestone escarpment. In these areas, tillage and logging operations are hindered and livestock can be lost or trapped if they are not fenced. These areas make up less than 5 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of availa site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIe.

163C—Fayette silt loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on convex, narrow ridges and long side slopes on uplands. Individual areas are irregular in shape and range from 20 to 70 acres in size.

Typically, the surface layer is about 7 inches thick. It is dark grayish brown, friable silt loam mixed with some brown streaks and pockets. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil extends to a depth of about 60 inches or more. It is brown, friable silty clay loam in the upper part; dark yellowish brown and yellowish brown, friable silty clay loam in the middle part; and yellowish brown, friable silt loam with light brownish gray mottles in the lower part.

Included with this soil in mapping are sinkholes that are 20 to 30 feet in diameter and 10 to 20 feet deep. The sinkholes are scattered randomly 10 to 100 feet apart and occur adjacent to the Silurian limestone escarpment. In these areas, tillage and logging operations are hindered and livestock can be lost or trapped if the sinkholes are not fenced. These areas make up less than 5 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. It generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. Some areas remain in timber. A few areas are used as residential sites because they offer a scenic view and are accessible from main roads in the county. This soil is moderately well suited to corn, soybeans, and small grains and well suited to grasses and legumes for hay and pasture. Erosion is a hazard in cultivated areas. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, help to reduce soil loss. In many areas, the slope is long and uniform enough to permit terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is well suited to trees, and many areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

163C2—Fayette silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, well drained soil on convex, narrow ridges and long side slopes in the uplands. Individual areas are irregular in shape and range from 30 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. There are some pockets of yellowish brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 50 inches thick. The upper part of the subsoil is dark yellowish brown, friable silty clay loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are areas of soils that have a surface layer of yellowish brown silty clay loam. In these areas, which are scattered throughout the map unit, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. The included soils make up less than 5 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is medium. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Fayette soils. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. Generally, this soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. Some areas are in pasture. A few areas are used as residential sites because they offer a scenic view and are accessible from main roads in the county. This soil is moderately well suited to corn, soybeans, and small grains and well suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and uniform enough to permit terracing and contour farming. More fertilizer is needed on this soil than on the uneroded Fayette soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is well suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

163D—Fayette silt loam, 9 to 14 percent slopes. This is a strongly sloping, well drained soil on convex, narrow ridges and long side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 7 inches thick. The subsoil to a depth of about 60 inches is yellowish brown, friable silt loam in the upper part; yellowish brown, friable silty clay loam in the middle part; and yellowish brown, friable silt loam with light brownish gray mottles in the lower part.

Included with this soil in mapping are sinkholes that are 20 to 30 feet in diameter and 10 to 20 feet deep. The sinkholes are scattered randomly 10 to 100 feet apart and occur adjacent to the Silurian limestone escarpment. In these areas, tillage and logging operations are hindered and livestock can be lost or trapped if they are not fenced. These included areas make up less than 5 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Some areas of this soil are in pasture or cultivated crops in rotation with hay, but most areas remain in timber. This soil is suited to occasional corn crops in rotation with small grains and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and uniform enough to permit terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is well suited to trees, and most areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

163D2—Fayette silt loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, well drained soil on convex, narrow ridges and long side slopes on uplands. Individual areas are irregular in shape and range from 20 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. It has pockets of yellowish brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 47 inches thick. The upper part of the subsoil is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils formed in glacial till. They cause the surrounding Fayette soils to be seepy during wet seasons, and they are low in fertility. Also included on the lower part of side slopes are small areas of limestone outcrops, which hinder tillage. In some areas, where subsoil material has been mixed into the plow layer, the surface layer is yellowish brown silty clay loam. In these areas, which are scattered throughout the map unit, the content of organic matter is low, tilth is poor, and more fertilizer is required. The included soils and the areas of outcrops make up 5 to 10 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Fayette soils. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally is high in available phosphorus and very low in available potassium. Generally, this soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are cultivated. A few areas are in pasture. This soil is suited to occasional crops of corn in rotation with small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to further erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, the slope is long and uniform enough to permit terracing and contour farming. More fertilizer is needed on this soil than on the uneroded Fayette soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is well suited to trees, and a few scattered areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

163D3—Fayette silty clay loam, 9 to 14 percent slopes, severely eroded. This is a strongly sloping, well drained soil on convex, narrow ridges and long side slopes in the uplands. Individual areas are irregular in shape and are generally 10 to 50 acres in size.

Typically, the surface layer is yellowish brown, friable silty clay loam about 6 inches thick. It is 10 to 15 percent dark grayish brown silt loam in pockets which make up the ramainder of the original surface layer. The subsoil is about 42 inches thick. The upper part of the subsoil is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam and silt loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till and are low in fertility, cause the surrounding Fayette soils to be seepy during wet seasons. Also included on the lower part of side slopes are small areas of limestone outcrops, which hinder tillage. The included areas make up less than 5 percent of this map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the less eroded Fayette soils. The content of organic matter in the surface layer is less than 0.5 percent. Typically, the surface layer is medium acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has poor tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. A few areas are in pasture. This soil is suited to occasional corn in rotation with small grains. It is better suited, however, to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In a few areas, the slope is long and uniform enough to permit terracing and contour farming. More nitrogen fertilizer is needed on this soil than on the less eroded Fayette soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is poorly suited to trees. Tree plantings do not survive and grow so well on this severely eroded soil as on the less eroded soils. Site preparation and control of competing plants are necessary to establish plantings. Disturbing the soil in planting can cause additional erosion.

This soil is in capability subclass IVe.

163E—Fayette silt loam, 14 to 18 percent slopes. This is a moderately steep, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated or irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 47 inches thick. The upper part of the subsoil is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Some areas of this soil are in permanent pasture, and a few areas are in cultivated crops in rotation with hay. This soil is suited to occasional crops of corn in rotation with small grains. It is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is well suited to trees, and most areas remain in native hardwoods. Because erosion is a hazard, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes operating equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IVe.

163E2—Fayette silt loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated or irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 7 inches thick. There are some pockets of dark yellowish brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 47 inches thick. The upper part of the subsoil is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till, cause the surrounding Fayette soils to be seepy during wet seasons. The Lindley soils are low in fertility. Also included on the lower part of side slopes are small areas of limestone outcrops, which hinder tillage. In some areas, the surface layer is yellowish brown silty clay loam. In these areas, which are scattered throughout the map unit, the organic matter content is low, tilth is poor, and larger amounts of fertilizer are required. The included soils and the areas of outcrops make up 5 to 10 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Fayette soils. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. Generally, this soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Many areas of this soil are in cultivated crops. A few areas are in pasture. This soil is suited to occasional crops of corn in rotation with small grains and to grasses and legumes for hay and pasture. This soil is best suited to hay and pasture. If it is used for cultivated crops, erosion is a hazard. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. More fertilizer is needed on this soil than on the uneroded Fayette soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few scattered areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IVe.

163E3—Fayette silty clay loam, 14 to 18 percent slopes, severely eroded. This is a moderately steep, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated or irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is dark yellowish brown, friable silty clay loam about 6 inches thick. It is 10 to 15 percent pockets of dark grayish brown, friable, silt loam material of the original surface layer. The subsoil is about 38 inches thick. It is yellowish brown, friable silty clay loam and silt loam with light brownish gray mottles in the lower part. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till, cause the surrounding Fayette soils to be seepy during wet seasons. The

Lindley soils are low in fertility. Also included on the lower part of side slopes are small areas of limestone outcrops, which hinder tillage. The included areas make up less than 5 percent of the map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on less eroded Fayette soils. The content of organic matter in the surface layer is less than 0.5 percent. Typically, the surface layer is medium acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has poor tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. Some areas are being returned to permanent pasture. This soil generally is not suited to cultivated crops. Crops that require tillage should be grown only to reestablish grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. More nitrogen fertilizer is needed on this soil than on the less eroded Fayette soils. The regular addition of organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is poorly suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. Because the soil is steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Tree plantings do not survive and grow so well on this severely eroded soil as on the less eroded soils. Site preparation and control of competing plants are necessary to establish plantings. Disturbing the soil in planting can cause additional erosion.

This soil is in capability subclass VIe.

163F—Fayette silt loam, 18 to 25 percent slopes. This is a steep, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated or irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 45 inches thick. The upper part of the subsoil is yellowish brown, friable silty clay loam, and the lower part is light yellowish brown, friable silt loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in trees, but some are in permanent pasture. The operation of equipment is difficult on this soil because of the slope and the presence of gullies and drainageways. If this soil is used for cultivated crops, it is subject to severe erosion damage.

The use of this soil for pasture effectively controls erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and most areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

163F2—Fayette silt loam, 18 to 25 percent slopes, moderately eroded. This is a steep, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated or irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. There are pockets of yellowish brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 43 inches thick. The upper part of the subsoil is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silt loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till, cause the surrounding Fayette soils to be seepy during wet seasons. The Lindley soils are low in fertility. Also included on the lower part of side slopes are small areas of limestone outcrops, which hinder tillage. In some areas, the surface layer is yellowish brown silty clay loam. In these areas, which are scattered throughout the map unit, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. The included soils and the areas of outcrops make up 5 to 10 percent of this map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Fayette soils. The content or organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is slightly acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. Generally, this soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Many areas of this soil are in cultivated crops, although some areas are seeded to pasture. This soil generally is not suited to cultivated crops, but is suited to hay or pasture. The opertion of equipment is difficult on this soil because of the slope and the gullies and drainageways. Structures designed to control the formation of gullies can reduce erosion on this soil (fig. 10). If this soil is used for cultivated crops, there is a serious hazard of erosion and of accumulation of silt on lower lying soils. Crops that require tillage should be grown only to reestablish grasses and legumes for hay and pasture.

The use of this soil for pasture effectively controls erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees, and scattered areas remain in native hardwoods. Because erosion is a hazard, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. Because this soil is steep, there is some risk involved in operating equipment. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

163F3—Fayette silty clay loam, 18 to 25 percent slopes, severely eroded. This is a steep, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated or irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is yellowish brown, friable silty clay loam about 5 inches thick. It is 10 to 15 percent brown, friable silt loam in pockets which make up the remainder of the original surface layer. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silt loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till, cause the surrounding Fayette soils to be seepy during wet seasons. The Lindley soils are low in fertility. Also included on the lower part of side slopes are small areas of limestone outcrops, which hinder tillage. The included soils and the areas of outcrops make up less than 5 percent of this map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the less eroded Fayette soils. The content of organic matter in the surface layer is less than 0.5 percent. Typically, the surface layer is medium acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has poor tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Many areas of this soil are in cultivated crops in rotation with hay. This soil generally is not suited to cultivated crops. It is suited to hay or pasture. The operation of equipment is difficult on this soil because of the slope and the presence of gullies and drainageways. Structures designed to control the formation of gullies can reduce the erosion rate on this soil. If this soil is used for cultivated crops, erosion is a hazard. Crops that require tillage should be grown only to reestablish grasses and legumes for hay and pasture. More nitrogen fertilizer is needed on this soil than on the less eroded Fayette soils.

The use of this soil for pasture effectively controls erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and excessive runoff. Proper stocking, pasture rotation, timely

Figure 10.—Erosion control structures are commonly used on steep slopes of the Fayette soils to control gully erosion. Some of these structures provide water for livestock and recreation.

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

This soil is poorly suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Tree plantings do not survive and grow so well on this severely eroded soil as on the less eroded soils. Site preparation and control of competing plants are necessary to establish plantings. Disturbing the soil in planting can cause additional erosion.

This soil is in capability subclass VIe.

163G—Fayette silt loam, 25 to 40 percent slopes. This is a very steep, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated or irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part of the subsoil is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown and light brownish gray mottles.

Included with this soil in mapping are small areas of limestone outcrops on the lower part of side slopes. The Fayette soil surrounding these areas is droughty late in the growing season because of the outcrops. These outcrops make up less than 5 percent of this map unit.

Permeability of this Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is acid. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. If cultivated, this soil has fair tilth. It also crusts after hard rains and puddles if worked when it is wet.

Most areas of this soil are in trees. This soil is not suited to cultivated crops or hay. Ordinary equipment cannot be used on this soil because of the slope.

This soil is poorly suited to pasture. Grazing must be limited. In the many areas where the slope prevents the application of fertilizer and lime, pasture yields are low.

This soil is well suited to trees, and most areas remain in native hardwoods. These areas of native hardwoods can be relatively productive with good timber management. Good management includes the use of selective cutting and protection from livestock and fire. Site preparation and control of competing plants are necessary to establish plantings. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIIe.

171B—Bassett loam, 2 to 5 percent slopes. This is a gently sloping, moderately well drained soil on convex ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 60 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 9 inches thick. The subsurface layer is dark grayish brown, friable loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part of the subsoil is yellowish brown, friable loam; the middle part is yellowish brown, friable clay loam; and the lower part is strong brown, firm loam with some light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray mottles. In some small areas, the subsoil is firm clay loam. These areas are on the higher parts of the landscape.

Included with this soil in mapping are small areas where the surface layer is loamy sand or sand. In these areas, which are scattered throughout the map unit, the available water capacity and organic matter content are low. These included areas make up less than 5 percent of the map unit.

Permeability of this Bassett soil is moderate, but the upper part of the subsoil is more permeable than the lower part of the subsoil and the substratum. Surface runoff is medium. The firm glacial till in the lower part of the subsoil tends to perch water, which results in wet seepy areas at the base of side slopes. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Reaction in the surface layer varies widely as a result of local liming practices, but the soil is typically strongly acid at a depth of about 20 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth. It tends to puddle if tilled when it is wet.

Most areas of this soil are cultivated. This soil is well suited to intensive row crop production of corn and soybeans. It is also well suited to small grains and grasses or legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. In many areas, the slope is long and smooth enough to permit terracing and contour farming. A combination of terracing and tile drainage can reduce the hazard of erosion on this soil. Where terraces are used, tile drainage may also be needed to avoid wet seepy areas in terrace channels. Cuts should be held to a minimum to avoid unnecessary exposure of the less productive, underlying glacial till, which is low in fertility. Stones from the subsoil may interfere with some tillage operations. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and some small areas remain in native hardwoods. There should be no problems in planting new stands of trees if species are selected and managed properly.

This soil is in capability subclass IIe.

171C—Bassett loam, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on convex ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to more than 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. The subsurface layer is brown, friable loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part of the subsoil is yellowish brown, friable loam; the middle part is yellowish brown, friable clay loam; and the lower part is strong brown and grayish brown, firm loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray mottles.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. In these areas the soil is droughty and is lower in content of organic matter. Also, on some lower shoulder positions, where glacial till is exposed on the surface, the soil is low in fertility and less productive and may develop wet seepy areas in some years. The included areas make up less than 5 percent of this map unit.

Permeability of this Bassett soil is moderate. The soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The firm glacial till in the lower part of the subsoil tends to perch water, which results in wet seepy areas at the base of side slopes. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 2.5 percent. Reaction in the surface layer varies widely as a result of local liming practices, but the soil is typically strongly acid at a depth of about 20 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if tilled when it is wet.

Most areas of this soil are cultivated. This soil is moderately well suited to row crops, such as corn and soybeans. It is well suited to small grains and grasses or legumes for hay or pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. A combination of terracing and tile drainage can reduce the hazard of erosion on this soil. Where terraces are used, tile drainage may also be needed to avoid wet seepy areas in terrace channels. Cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till. Glacial till is low in fertility. Stones from the subsoil may interfere with some tillage operations. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and some small areas remain in native hardwoods. There should be no particular problems in planting new stands of trees if species are selected and managed properly.

This soil is in capability subclass IIIe.

171C2—Bassett loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, moderately well drained soil on convex ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. There are some streaks and pockets of yellowish brown, friable loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 33 inches thick. The upper part of the subsoil is yellowish brown, friable loam; the middle part is yellowish brown, friable clay loam; and the lower part is strong brown and grayish brown, firm loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray mottles.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. In these areas the soil is droughty and is lower in content of organic matter. On some lower shoulder positions, where glacial till is exposed on the surface, the soil is low in fertility and less productive and may develop wet seepy areas in some years. The included areas make up about 5 to 10 percent of this map unit.

Permeability of this Bassett soil is moderate. The soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The firm glacial till in the lower part of the subsoil tends to perch water, which results in wet seepy areas at the base of side slopes. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Bassett soils. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction in the surface layer varies widely as a result of local liming practices, but the soil typically is strongly acid at a depth of about 20 inches. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are cultivated. This soil is moderately well suited to row crops, such as corn and soybeans. It is well suited to small grains and grasses or legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. A combination of terracing and tile drainage can reduce the hazard of erosion on this soil. Where terraces are used, tile drainage may also be needed to avoid wet seepy areas in terrace channels. Cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till. Glacial till is low in fertility. Stones from the subsoil may interfere with some tillage operations. More fertilizer is needed on this soil than on the uneroded Bassett soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. There should be no problems in planting new stands of trees if species are selected and managed properly.

This soil is in capability subclass IIIe.

171D—Bassett loam, 9 to 14 percent slopes. This is a strongly sloping, moderately well drained soil on convex ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown and brown, friable loam about 6 inches thick. The subsurface layer is brown, friable loam about 5 inches thick. The subsoil is about 30 inches thick. The upper part of the subsoil is yellowish brown, friable loam; the middle part is yellowish brown, friable clay loam; and the lower part is strong brown, firm loam with some light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray mottles.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. In these areas the soil is droughty and is lower in content of organic matter. On some convex knolls, where glacial till is exposed on the surface, the soil is low in fertility and less productive and may develop wet seepy areas in some years. The included areas make up 5 to 10 percent of the map unit.

Permeability of this Bassett soil is moderate. The soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The firm glacial till in the lower part of the subsoil tends to perch water, which results in wet seepy areas at the base of side slopes. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 2.5 percent. Reaction in the surface layer varies widely as a result of local liming practices, but the soil typically is strongly acid at a depth of about 20 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if tilled when it is wet.

Most areas of this soil are cultivated. This soil is moderately well suited to row crops, such as corn and soybeans. It is also moderately well suited to small grains and grasses or legumes for hay or pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. A combination of terracing and tile drainage can reduce the hazard of erosion on this soil. Where terraces are used, tile drainage may also be needed to avoid wet seepy areas in terrace channels. Cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till, which is low in fertility. Stones from the subsoil may interfere with some tillage operations. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and some small areas remain in native hardwoods. There should be no problems in planting new stands of trees if species are selected and managed properly.

This soil is in capability subclass IIIe.

171D2—Bassett loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, moderately well drained soil on convex side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. There are some pockets of dark yellowish brown, friable loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 30 inches thick. The upper part of the subsoil is yellowish brown, friable loam; the middle part is yellowish brown, friable clay loam; and the lower part is strong brown and grayish brown, firm loam with light brownish gray mottles. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray mottles. In some places, the surface layer is yellowish brown, friable loam.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. In these areas the soil is droughty and is lower in content of organic matter. On some lower shoulder positions, where glacial till is exposed on the surface, the soil is low in fertility and less productive and may develop wet seepy areas in some years. The included areas make up about 5 to 10 percent of this map unit.

Permeability of this Bassett soil is moderate. The soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The firm glacial till in the lower part of the subsoil tends to perch water, which results in wet seepy areas at the base of side slopes. The available water capacity is high. There is more runoff and less infiltration of water on this soil than on the uneroded Bassett soils. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction in the surface layer varies widely as a result of local liming practices, but the soil typically is strongly acid at a depth of about 20 inches. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are cultivated. This soil is moderately well suited to row crops, such as corn and soybeans. It is also moderately well suited to small grains and grasses or legumes for hay or pasture. If this soil is used for cultivated crops, erosion is a hazard. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. A combination of terracing and tile drainage can reduce the hazard of erosion on this soil. Where terraces are used, tile drainage may also be needed to avoid wet seepy areas in terrace channels. Cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till. Glacial till is low in fertility. Stones from the subsoil may interfere with some tillage operations. More fertilizer is needed on this soil than on the uneroded Bassett soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. There should be no problems in planting new stands of trees if species are selected and managed properly.

This soil is in capability subclass IIIe.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This is a gently sloping, somewhat excessively drained soil on convex ridges and side slopes in the uplands and on stream terraces. Individual areas are oblong and irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark brown, friable fine sandy loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown, friable fine sandy loam about 12 inches thick. The subsoil is about 28 inches thick. The upper part of the subsoil is brown, very friable sandy loam, and the lower part is brown and yellowish brown, very friable loamy sand and sand. The substratum to a depth of about 60 inches is yellowish brown sand with thin bands of brown sandy loam. In a few areas on uplands, loamy glacial till is at a depth of about 3 feet.

Included with this soil in mapping are a few small areas of Flagler soils on stream terraces. The soils in these areas are sand and gravel at a depth of about 2 to 3 feet and are droughty. These included soils make up less than 5 percent of this map unit.

Permeability of this Dickinson soil is moderately rapid, and surface runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is slightly acid or medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and easily tilled throughout a wide range in moisture content. This soil may crust after hard rains.

Most areas of this soil are in cultivated crops and hay. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to wind and water erosion. This soil is droughty, but production of crops is good if rainfall is normal and timely. Conservation tillage, which leaves crop residue on the surface throughout the year, and stripcropping can reduce soil erosion and conserve moisture. Returning crop residue to the soil or regularly adding other organic material increases fertility.

The use of this soil for pasture or hay effectively controls erosion. Proper stocking, pasture rotation, and timely deferment of grazing, especially during dry periods, help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

175C—Dickinson fine sandy loam, 5 to 12 percent slopes. This moderately sloping, somewhat excessively drained soil is on convex ridges and side slopes in the uplands and on stream terraces. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark brown, friable fine sandy loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown, friable fine sandy loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part of the subsoil is brown, very friable fine sandy loam, and the lower part is yellowish brown and dark yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown loamy fine sand. In a few areas on uplands, loamy glacial till is at a depth of about 3 feet.

Permeability of this Dickinson soil is moderately rapid, and surface runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is about 1 to 1.5 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. Lime is generally needed if it has not been applied in the past 3 or 4 years. The subsoil is slightly acid. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and easily tilled throughout a wide range in moisture content. This soil may crust after hard rains.

Most areas of this soil are in cultivated crops and hay. This soil is poorly suited to corn, soybeans, and small grains. It is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to wind and water erosion. This soil is droughty, and the production of all crops depends on the amount and timeliness of rainfall. Conservation tillage, which leaves crop residue on the surface throughout the year, and stripcropping can reduce soil erosion and conserve moisture. Returning crop residue to the soil or regularly adding other organic material increases fertility.

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

This soil is in capability subclass IIIe.

183D—Dubuque silt loam, 20 to 30 inches to limestone, 9 to 14 percent slopes. This is a strongly sloping, well drained soil on short, convex side slopes on uplands. Individual areas are elongated and range from 5 to 30 acres in size.

Typically, the surface layer is very dark gray and dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown and brown, friable silt loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is brown, firm clay. The subsoil is underlain at a depth of 27 inches by hard, fractured limestone. In some places, there are small areas where limestone bedrock is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of limestone outcrops. The outcrops are irregularly spaced on the lower part of side slopes and hinder tillage. These included areas make up less than 5 percent of this map unit.

Permeability of this Dubuque soil is moderate, and surface runoff is rapid. The available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. The subsoil is medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. In cultivated areas, it has a tendency to puddle if worked when it is wet and to crust after heavy rains.

Most areas of this soil are in trees and pasture. This soil is suited to occasional cultivated crops in rotation with hay. If the soil is used for cultivated crops, erosion is a hazard. Any loss of soil material because of erosion decreases the depth to limestone and affects the use of this soil. Lack of moisture is likely to damage crops if rainfall is not timely during the growing season. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. Terraces are poorly suited on this soil because the soil is shallow to bedrock. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is well suited to trees, and most areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IVe.

183D2—Dubuque silt loam, 20 to 30 inches to limestone, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, well drained soil on short, convex side slopes on uplands. Individual areas are elongated and range from 5 to 30 acres in size.

Typically, the surface layer is mixed dark grayish brown and brown, friable silt loam about 7 inches thick. There are some pockets of yellowish brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 20 inches thick. The upper part of the subsoil is yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is brown, firm clay. The subsoil is underlain at a depth of about 27 inches by hard, fractured limestone. In some small areas limestone bedrock is at a depth of 30 to 40 inches. In a few areas, the surface layer is very dark grayish brown, friable silt loam.

Included with this soil in mapping are small areas where the surface layer is yellowish brown silty clay loam. In these areas the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. These included areas make up less than 5 percent of this map unit.

Permeability of this Dubuque soil is moderate, and surface runoff is rapid. The available water capacity is low. There is more runoff and less infiltration of water on this soil than on the uneroded Dubuque soils. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is slightly acid. The subsoil is medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It becomes cloddy and will puddle if worked when it is wet and has a tendency to crust after heavy rains.

Many areas of this soil are in cultivated cropland. This soil is poorly suited to cultivated crops. It is susceptible to severe erosion when cultivated. Any loss of soil material because of erosion decreases the depth to limestone and affects the use of this soil. Lack of moisture is likely to damage crops if rainfall is not timely during the growing season. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. Terraces are poorly suited to this soil because the soil is shallow to bedrock. More fertilizer is needed on this soil than on the uneroded Dubuque soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IVe.

183E—Dubuque silt loam, 20 to 30 inches to limestone, 14 to 18 percent slopes. This is a moderately sloping, well drained soil on short, convex side slopes on uplands. Individual areas are elongated and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is brown, firm clay. The subsoil is underlain at a depth of about 24 inches by hard, fractured limestone. In some small areas, limestone bedrock is at a depth of about 30 to 40 inches.

Included with this soil in mapping are small areas of Nordness soils. Nordness soils have limestone bedrock at a depth of 18 inches or less and are more droughty. Also included are a few small areas of limestone outcrops. The outcrops are irregularly spaced on the lower part of side slopes and hinder tillage operations. The included areas make up less than 5 percent of this map unit.

Permeability of this Dubuque soil is moderate, and surface runoff is rapid. The available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid. The subsoil is medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. In cultivated areas, it has a tendency to puddle if worked when it is wet and to crust after heavy rains.

Most areas of this soil are in trees or permanent pasture. This soil generally is not suited to cultivated crops and only moderately well suited to hay. If this soil is cultivated, there is a hazard of severe erosion. Crops that require tillage should be grown only to reestablish meadow. Any loss of soil material through erosion decreases the depth to limestone and affects the use of this soil.

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

This soil is well suited to trees, and a few areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails and roads on the contour or nearly on the contour can reduce soil erosion. The slopes make the operation of equipment hazardous. Special equipment can be used, but with caution. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

183E2—Dubuque silt loam, 20 to 30 inches to limestone, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, well drained soil on short, convex side slopes on uplands. Individual areas are elongated and range from 5 to 30 acres in size.

Typically, the surface layer is mixed dark grayish brown and brown, friable silt loam about 6 inches thick. There are some pockets of yellowish brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 15 inches thick. The upper part of the subsoil is yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is brown, firm clay. The subsoil is underlain at a depth of about 21 inches by hard, fractured limestone. In some small areas, limestone bedrock is at a depth of 30 to 40 inches. In a few areas, the surface layer is very dark grayish brown, friable silt loam.

Included with this soil in mapping are small areas of Nordness soils. Nordness soils have limestone bedrock at a depth of 18 inches and are more droughty. Also included are a few small areas of lmestone outcrops. The outcrops are irregularly spaced on the lower part of side slopes, and they hinder tillage operations. In some areas the surface layer is yellowish brown silty clay loam. In these areas, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. The included soils and the areas of outcrops make up less than 5 percent of this map unit.

Permeability of this Dubuque soil is moderate, and surface runoff is rapid. The available water capacity is low. There is more runoff and less infiltration of water on this soil than on the uneroded Dubuque soils. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is slightly acid. The subsoil is medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It becomes cloddy and puddles if worked when it is wet and has a tendency to crust after heavy rains.

Most areas of this soil are in cultivated crops, although some areas are being returned to pasture. This soil generally is not suited to cultivated crops and is poorly suited to hay. If the soil is cultivated, erosion is a severe hazard. Crops that require tillage should be grown only to reestablish meadow. Any loss of soil material through erosion decreases the depth to limestone and affects the use of this soil. More fertilizer is needed on this soil than on the uneroded Dubuque soils.

The use of this soil for pasture effectively controls erosion. Overgrazing or grazing when the soil is wet, however, causes surface compaction and increases runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

198B—Floyd loam, 1 to 4 percent slopes. This is a very gently sloping, somewhat poorly drained soil on concave side slopes and on side slopes along upland drainageways. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is black, friable loam about 7 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable loam about 12 inches thick. The subsoil is about 32 inches thick. The upper part of the subsoil is dark grayish brown, friable loam; the middle part is light olive brown and grayish brown, friable loam with yellowish brown mottles; and the lower part is yellowish brown and light brownish gray, firm loam. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm loam.

Included with this soil in mapping are small areas of poorly drained Clyde soils. Clyde soils are in small depressions and along drainageways. These areas of Clyde soils stay wetter for longer periods and may delay field operations. These included soils make up less than 5 percent of this map unit.

Permeability of this Floyd soil is moderate. This soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is slow. This soil has a seasonal high water table at a depth of 2 to 4 feet. The available water capacity is high. The content or organic matter in the surface layer is about 5 to 7 percent. Typically, reaction is neutral to slightly acid throughout the profile. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if tilled when it is wet.

Most areas of this soil are cultivated. This soil is well suited to intensive use for row crops such as corn and soybeans. This soil is also well suited to small grains and grasses or legumes for hay or pasture. Gully erosion is a hazard where runoff is concentrated. This soil should be protected from surface runoff from higher elevations. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, help prevent excessive soil loss. Where row crops are grown, artificial drainage is needed to lower the water table, thus improving conditions for field operations. Because it is difficult to control erosion and excessive wetness, a combination of terraces and tile drainage may be needed on this soil and the adjacent soils. Glacial stones and boulders are common in many unimproved areas and need to be removed before this soil can be tile drained and cultivated. Tile placement may be difficult because of very friable, water-bearing erosional sediment. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is in capability subclass IIw.

249B—Zwingle silt loam, 2 to 7 percent slopes. This is a gently sloping to moderately sloping, poorly drained soil on high stream terraces along major tributaries of the Mississippi River. Individual areas are elongated or irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is grayish brown and gray, friable silt loam about 4 inches thick. The subsoil is about 39 inches thick. The upper part of the subsoil is brown, firm silty clay; the lower part is brown and dark yellowish brown, friable silty clay loam and silt loam with strong brown and grayish brown mottles. The substratum to a depth of about 60 inches is stratified dark yellowish brown, yellowish brown, and brown silty clay loam and fine sandy loam. In some places, there are nearly level soils that have a black surface layer and a gray subsoil.

Included with this soil in mapping are a few small, narrow, steep escarpments located on the stream side of terraces. These areas make tillage operations difficult and increase runoff if special management practices are not used. These included areas make up less than 5 percent of this map unit.

Permeability of this Zwingle soil is very slow, and surface runoff is slow to medium. This soil has a seasonal high water table at a depth of 1 to 2 feet. The available water capacity is moderate. The content of organic matter in the surface layer is about 1 to 2 percent. The shrink-swell potential is high. Typically, reaction in the surface layer is neutral or slightly acid and the subsoil is strongly acid to medium acid. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium. This soil has fair tilth. The surface layer puddles easily if worked when it is wet, is generally difficult to work, and tends to crust after hard rains.

Most areas of this soil are in permanent pasture. Some areas are used as residential sites. This soil is poorly suited to corn, soybeans, and small grains. It is better suited to grasses and legumes for hay and pasture. Several properties of this soil cause management problems. Erosion is a hazard if this soil is cultivated. This soil is poorly suited to terraces because of the clayey subsoil. Wetness is also a problem. Tile drainage cannot be used satisfactorily on this soil because of the high clay content and slow permeability. Returning crop residue to the soil or regularly adding other organic material increases fertility and improves tilth.

Although this soil is not well suited to pasture, it can be used for pasture and can be moderately productive if it is well managed. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and puddling. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are needed for maximum productivity.

This soil is poorly suited to trees, and some areas remain in native hardwoods. This soil is poorly drained, and the use of equipment needs to be restricted to drier periods or the winter months when the ground is frozen. Special high flotation equipment may also be used for harvesting or management if it is necessary during wet periods. Natural and planted seedlings do not survive well. They can be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. Erosion is not a hazard on this soil during logging and road construction.

This soil is in capability subclass IIIe.

284B—Flagler sandy loam, 2 to 5 percent slopes. This is a gently sloping, somewhat excessively drained soil on convex terraces along streams and outwash plains of the uplands. Individual areas are broad and irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is very dark brown, very friable sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown, dark brown, and dark yellowish brown, friable sandy loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable sandy loam, and the lower part is brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown and yellowish brown, loose sand that is 5 to 10 percent fine gravel.

Permeability of this Flagler soil is moderately rapid in the loamy material and very rapid in the underlying sand and gravel. Surface runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is about 1 to 2 percent. Reaction in the surface layer varies as a result of local liming practices. Lime is generally needed if it has not been applied in the past 3 to 5 years. Typically, the subsoil is slightly acid to medium acid. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. This soil tends to crust after hard rains.

Most areas of this soil are in cultivated crops, hay, and pasture. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to wind and water erosion. This soil is droughty, and crop production is low unless rainfall is above normal and timely. Conservation tillage, which leaves crop residue on the surface throughout the year, reduces soil erosion and conserves moisture. Returning crop residue to the soil or regularly adding other organic material increases fertility, improves tilth, and increases the infiltration of water.

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

This soil is in capability subclass IIIe.

285D—Burkhardt sandy loam, 5 to 14 percent slopes. This is a moderately sloping to strongly sloping, excessively drained soil on terrace escarpments along streams and on outwash plains of the uplands. Individual areas are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is about 6 inches thick. It is very dark grayish brown, very friable sandy loam mixed with dark brown streaks and pockets of subsoil material. This layer is about 12 percent fine gravel. The subsoil is about 11 inches thick. The upper part of the subsoil is dark brown, friable gravelly sandy loam with about 25 percent fine gravel, and the lower part is brown, very friable gravelly loamy sand with about 20 percent fine gravel. The substratum to a depth of about 60 inches is yellowish brown and strong brown, loose, stratified coarse sand and gravel. In some places, the surface layer is dark grayish brown or brown and the subsoil and substratum are redder than is typical.

Included with this soil in mapping are scattered areas where coarse gravel is on the surface. These areas are difficult to till and can cause excessive wear on farm machinery. They make up about 5 to 10 percent of this map unit.

Permeability of this Burkhardt soil is moderately rapid in the surface layer and rapid in the underlying material. Surface runoff is medium. The available water capacity is very low. The content of organic matter in the surface layer is about 0.5 to 1.5 percent. Reaction in the surface layer varies as a result of previous liming practices. Generally, this soil needs lime if it has not been applied in the past 3 or 4 years. The subsoil is slightly acid or medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. This soil tends to crust after hard rains.

Most areas of this soil are farmed with soils in adjacent areas and are generally in a cropping system that includes corn, oats, and hay. This soil generally is not suited to corn, soybeans, or small grains. It is better suited to grasses and legumes for hay and pasture. If cultivated, this soil is very droughty and is subject to wind and water erosion. Conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil erosion and conserve moisture. Returning crop residue to the soil or regularly adding other organic material increases fertility and improves tilth.

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

This soil is suited to trees, and some areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. Because this soil is steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Seedlings do not survive well. They can be planted close together to achieve the desired stand density.

This soil is in capability subclass VIs.

291—Atterberry silt loam, 1 to 3 percent slopes. This is a very gently sloping, somewhat poorly drained soil on broad, upland ridgetops or divides and on convex side slopes near drainageways. Individual areas are smooth and irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown and grayish brown, friable silt loam about 6 inches thick. The subsoil is friable and is about 32 inches thick. The upper part of the subsoil is brown silt loam with grayish brown and yellowish brown mottles; the middle part is grayish brown silty clay loam with yellowish brown mottles; and the lower part is light brownish gray silt loam with yellowish brown mottles. The substratum to a depth of about 60 inches is light brownish gray silt loam with strong brown mottles. In some small areas, there is a thicker dark surface layer.

Permeability of this Atterberry soil is moderate, and surface runoff is slow. This soil has a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. Typically, the surface layer is slightly acid to medium acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth, but the surface layer has a tendency to puddle if worked when it is wet. This soil will generally crust after hard rains if the platy subsurface layer is mixed into the plow layer during cultivation.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Farm operations are often delayed in spring and during wet periods because the water table is seasonally high. This soil benefits from tile drainage in most years, and tile permits consistent and timely field work. Conservation tillage, which leaves crop residue on the surface throughout the year, helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material increases fertility and improves tilth.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability class I.

315—Udifluvents, loamy, 0 to 2 percent slopes. These are level to very gently sloping, well drained and somewhat excessively drained soils on flood plains of major creeks and rivers in the southwestern and western parts of the county. These soils are subject to frequent flooding. Individual areas are broad and irregular in shape, extend for several miles in length, and range from 10 to more than 100 acres in size. Udifluvents are a broadly defined group of alluvial soils generally adjacent to stream channels on flood plains.

Typically, the surface layer is stratified very dark grayish brown and dark grayish brown, friable loam about 9 inches thick. The substratum to a depth of about 60 inches is stratified very dark grayish brown, dark grayish brown, and yellowish brown fine sandy loam, loamy fine sand, and silt loam.

Included in mapping are small areas of recently deposited sand. These areas occur as sand bars or sandy beaches. Also included are areas of gravelly and cherty sand along stream channels. They are lower in content of organic matter and are more frequently flooded. Also, there are small areas of poorly drained, loamy soils in depressions and in old, sediment-filled oxbows. These loamy soils have a seasonal high water table and pond water during spring months. The included areas make up about 15 percent of this map unit.

Permeability of these soils is quite variable, but in general, permeability is moderate, and surface runoff is slow. The available water capacity is generally high or medium. The organic matter content is generally less than 1 percent. Typically, reaction in the surface layer is neutral to mildly alkaline. The substratum generally has a low to very low supply of available phosphorus and potassium. The surface layer of these soils has fair tilth. Generally, these soils puddle if worked when they are wet and crust after hard rains.

Most areas of the soils in this map unit are used for pasture or woodland or are left idle; however, some areas are cultivated together with adjacent soils. These soils are generally not suited to corn, soybeans, and small grains. They are better suited to permanent grass in pasture and to woodland. These soils are frequently flooded and have a seasonal high water table. The level of water is often controlled by the nearby river. These areas should be left idle or used as habitat for wildlife.

These soils are suited to trees, and most areas remain in native hardwoods. Natural and planted seedlings do not survive well. They can be planted close together and thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

These soils are in capability subclass Vw.

320—Arenzville silt loam, 0 to 2 percent slopes. This is a nearly level, moderately well drained and well drained soil on narrow bottom lands and alluvial fans below more sloping, loess-covered upland soils. This soil is subject to occasional flooding. Individual areas are elongated and range from 50 to 200 acres in size.

Typically, the surface layer is very dark grayish brown and dark grayish brown, friable silt loam about 7 inches thick. The substratum, which is about 29 inches thick, is stratified dark grayish brown, grayish brown, and light brownish gray, friable silt loam with dark brown mottles in the lower part. It formed in recently deposited sediments. Below this is a buried black silt loam surface layer. The underlying material to a depth of 60 inches or more is dark gray silt loam with olive and olive brown mottles. In some small areas there is stratified silty sediment more than 40 inches thick.

Permeability of this Arenzville soil is moderate, and surface runoff is slow. This soil has a seasonal high water table at a depth of 3 to 6 feet. The available water capacity is high to very high. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, reaction is neutral or slightly acid throughout the profile. This soil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It has a tendency to puddle if worked when it is wet and to crust after heavy rains.

Many areas of this soil are cultivated. Some areas are in permanent pasture. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is susceptible to high-velocity flooding of short duration during periods of high rainfall. Crop damage may result. Levees and dikes may be beneficial in providing flood protection. Yields may vary considerably from year to year, depending on the frequency and time of year of the flooding.

This soil is suited to pasture, and some areas that are narrow and frequently flooded are in permanent pasture. Overgrazing or grazing during wet periods after flooding, however, causes surface compaction and puddling. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good conditon.

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation.

Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or harvesting trees; however, frequent flooding and siltation limit tree selection and accessibility.

This soil is in capability subclass IIw.

391B—Clyde-Floyd loams, 1 to 4 percent slopes. This complex consists of very gently sloping and gently sloping soils along drainageways on glacial uplands. In most places, the poorly drained Clyde soil is on the lowest part of drainageways on slopes of less than 2 percent and is bordered by a band of somewhat poorly drained Floyd soil on slopes of 1 to 4 percent. The Clyde and Floyd soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 55 percent Clyde soil and 45 percent Floyd soil. Individual areas range from 10 to more than 60 acres in size. Typically, the surface layer of the Clyde soil is black, friable loam about 8 inches thick. The subsurface layer is black and dark gray, friable clay loam about 15 inches thick. The subsoil is about 20 inches thick. The upper part of the subsoil is grayish brown, friable loam with light olive brown mottles and the lower part is grayish brown and yellowish brown, firm loam. The substratum to a depth of about 60 inches is gray and yellowish brown loam.

Typically, the surface layer of the Floyd soil is black, friable loam about 8 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable loam about 10 inches thick. The subsoil is about 33 inches thick. The upper part is dark grayish brown, friable loam; the middle part is light olive brown and grayish brown, friable loam with yellowish brown mottles; and the lower part is yellowish brown and light brownish gray, firm loam. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray loam. In some small areas the subsurface layer is brown with yellowish brown mottles.

Permeability of the Clyde and Floyd soils is moderate, but these soils are more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. A stone line may separate the loamy sediment on the surface and the underlying firm glacial till. Surface runoff is slow. The Clyde soil has a seasonal high water table at a depth of 1 to 2.5 feet. The Floyd soil has a seasonal high water table at a depth of 2 to 4 feet. The available water capacity is high for both soils. The content of organic matter in the surface layer of the Clyde soil is about 9 to 11 percent, and it is 5 to 7 percent in the Floyd soil. Typically, reaction is neutral to slightly acid throughout the profile of both soils. The subsoil of both soils generally has a very low supply of available phosphorus and potassium. The surface layer of the Clyde soil has fair tilth, and that of the Floyd soil has good tilth. These soils tend to puddle if tilled when wet.

Most areas of these soils are cultivated. These soils are well suited to intensive row crop production of corn, soybeans, and small grains and to grasses or legumes for hay and pasture, if they are artificially drained and protected from runoff from higher elevations. There is a hazard of gully erosion in areas of concentrated runoff. Conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. Grassed waterways help prevent gully erosion. Artificial drainage is needed for row crop production to lower the water table and to improve the timeliness of field operations. Glacial stones and boulders are common in many unimproved, undrained areas, and they need to be removed before these soils can be tile drained and cultivated. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

Areas of these soils that are not adequately drained are generally used for pasture. Overgrazing or grazing when the soils are too wet, however, causes surface compaction, reduced runoff, poor tilth, and damage to the vegetative cover. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

These soils are in capability subclass IIw.

394B—Ostrander loam, 2 to 5 percent slopes. This is a gently sloping, well drained soil on long, intermediate convex ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is very dark brown, friable loam about 9 inches thick. The subsoil extends to a depth of about 60 inches. The upper part of the subsoil is brown and dark yellowish brown, friable loam; the middle part is dark yellowish brown and yellowish brown, friable loam that is about 7 percent fine gravel; and the lower part is dark yellowish brown, firm loam that is about 5 percent fine gravel.

Included with this soil in mapping are scattered areas where the surface layer is loamy sand or sand. In some areas the surface layer is gravelly loamy sand or gravelly sandy loam. These areas are droughty and are low in organic matter content. The included areas make up less than 5 percent of this map unit.

Permeability of this Ostrander soil is moderate, but this soil is more permeable in the upper part of the subsoil than in the lower part. Surface runoff is medium. The available water capacity is high to very high. The content of organic matter in the surface layer is about 3 to 4 percent. Typically, reaction is neutral or slightly acid to a depth of about 20 inches, but it is medium acid or strongly acid at a depth of about 33 inches. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, supplemental drainage is seldom needed, but there is a hazard of erosion. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. In many areas slopes are long and smooth enough to permit terracing and contour farming. If terraces are used, however, cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till which is low in fertility. Stones from the subsoil may interfere with some tillage operations. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is in capability subclass IIe.

394C—Ostrander loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on intermediate ridges and side slopes in the uplands. Individual areas are irregular bands that range from 5 to 20 acres in size.

Typically, the surface layer is very dark brown, friable loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 7 inches thick. The subsoil is about 40 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable loam; the middle part is dark yellowish brown and yellowish brown, friable loam that is about 7 percent fine gravel; and the lower part is dark yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam that is about 5 percent fine gravel.

Included with this soil in mapping are scattered areas where the surface layer is loamy sand or sand. In some areas the surface layer is gravelly loamy sand or gravelly sandy loam. These areas are droughty and have a lower content of organic matter. The included areas make up about 5 to 10 percent of this map unit.

Permeability of this Ostrander soil is moderate, but this soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The available water capacity is high to very high. The content of organic matter in the surface layer is about 2.5 to 3 percent. Typically, reaction is neutral or slightly acid to a depth of about 15 inches, but it is medium acid or strongly acid at a depth of about 30 inches. Reaction varies widely in the surface layer as a result of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, supplemental drainage is seldom needed, but there is a hazard of erosion. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. In many areas slopes are long and smooth enough to permit terracing and contour farming. If terraces are used, however, cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till, which is low in fertility. Stones from the subsoil may interfere with some tillage operations. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is in capability subclass IIIe.

407B—Schley loam, 1 to 4 percent slopes. This is a gently sloping, somewhat poorly drained soil on uplands. Individual areas are irregular in shape and range from 5 to more than 60 acres in size.

Typically, the surface layer is very dark gray, friable loam about 7 inches thick. The subsurface layer is brown, friable loam about 8 inches thick with dark yellowish brown and yellowish brown mottles. The subsoil is 29 inches thick. The upper part of the subsoil is brown, friable loam with yellowish brown mottles; the middle part is mottled grayish brown and strong brown, friable loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas, silty sediment is underlain by glacial till. Also in some areas, glacial till is within 20 inches of the surface.

Included with this soil in mapping are some small scattered areas where the surface layer is gravelly loamy sand or loamy sand. These areas are lower than this Schley soil in organic matter content and available water capacity. Also included are some areas where clayey material is within 2 to 4 feet of the surface. In these areas, slow permeability may cause excessive wetness and seepiness for extended periods at the base of side slopes. The included areas make up about 5 to 10 percent of this map unit.

Permeability of this Schley soil is moderate. This soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is slow. This soil has an apparent high water table at a depth of 1 to 3 feet. The available water capacity is high. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. Typically, reaction is slightly acid to strongly acid in the surface layer. Reaction in the surface layer varies widely as a result of local liming practices. The subsoil is strongly acid to medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if tilled when it is wet. This soil will generally crust after hard rains if the platy subsurface layer is mixed into the plow layer during cultivation.

Most areas of this soil are cultivated. This soil is also well suited to row crops, such as corn and soybeans. This soil is also well suited to small grains, grasses, or legumes for hay or pasture. There is a hazard of gully erosion in areas where runoff is concentrated. This soil should be protected from surface runoff from higher elevations. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. Artificial drainage is needed for row crop production to lower the water table and to improve the timeliness of field operations. Because both erosion and excessive wetness are difficult to control, a combination of terraces and tile drainage may be needed on adjacent soils. Glacial stones and boulders are common in many unimproved areas and need to be removed before this soil can be tile drained and cultivated. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or harvesting trees. Use of equipment, however, should be restricted during wet seasons.

This soil is in capability subclass IIw.

408B—Olin fine sandy loam, 2 to 5 percent slopes. This is a gently sloping, well drained soil on convex ridgetops and side slopes in the uplands. Individual areas are oval or irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is very dark brown, friable fine sandy loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown, friable fine sandy loam about 13 inches thick. The subsoil is about 38 inches thick. It is brown, very friable sandy loam and loamy sand in the upper part; yellowish brown, friable loam in the middle part; and light yellowish brown and yellowish brown, firm loam in the lower part. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown loam. In places, there are a few small areas where glacial till is more than 40 inches below the surface. Also in some areas, the surface soil is brown and grayish brown.

Included with this soil in mapping are small areas of excessively drained Sparta soils at the slightly higher elevations. These soils are droughty, and they have a low available water capacity. These included soils make up less than 5 percent of this map unit.

Permeability of this Olin soil is moderate, but this soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and substratum. Surface runoff is medium. The firm glacial till in the lower part of the subsoil tends to perch water, resulting in wet seepy areas at the base of side slopes. A stone line separates the surface sediment from the underlying firm glacial till. Surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. The subsoil is medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and easily tilled throughout a fairly wide range in moisture content. This soil may crust after hard rains.

Most areas of this soil are cultivated. Many small areas of this soil are part of larger areas of soils that are better suited to crops and are used for crops. This soil is moderately well suited to row crops, such as corn and soybeans. It is also moderately well suited to small grains and grasses or legumes for hay or pasture. If this soil is used for cultivated crops, there is a hazard of wind erosion. Blowing sand grains sometimes damage newly seeded crops on this soil and on adjoining soils if the crops are not protected by vegetation. Conservation tillage, which leaves crop residue on the surface throughout the year, and cover crops can reduce soil loss. This soil is generally not well suited to terraces because of the moderately coarse textured material that is difficult to maintain as a terrace ridge and because of the shallowness to the less productive, underlying glacial till. If terraces are used, cuts should be held to a minimum. Droughtiness is a hazard unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

The use of this soil for pasture or hay is also 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 plants. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIe.

408C—Olin fine sandy loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on short, convex side slopes in the uplands. Individual areas are elongated and oval in shape and range from 3 to 15 acres in size.

Typically, the surface layer is very dark brown, friable fine sandy loam about 7 inches thick. The subsurface layer is very dark brown and very dark grayish brown, friable fine sandy loam about 13 inches thick. The subsoil is about 37 inches thick. The upper part of the subsoil is brown and yellowish brown, very friable fine sandy loam; the middle part is yellowish brown, friable loam; and the lower part is light yellowish brown and yellowish brown, firm loam. The substratum to a depth of about 60 inches is mottled yellowish brown and grayish brown loam. In places, there are a few small areas where glacial till is at a depth of more than 40 inches. Also in some areas, the surface soil is brown and grayish brown.

Included with this in mapping are areas of excessively drained Sparta soils on small knobs at the slightly higher elevations. These Sparta soils are droughty and have low available water capacity. These included soils make up less than 5 percent of this map unit.

Permeability of this Olin soil is moderate, but this soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The firm glacial till in the lower part of the subsoil tends to perch water resulting in wet seepy areas at the base of side slopes. A stone line separates the surface sediment from the underlying firm glacial till. Surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. The subsoil is slightly acid and medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer is very friable and easily tilled throughout a fairly wide range in moisture content. This soil may crust after hard rains.

Most areas of this soil are cultivated. Many small areas of this soil are part of larger areas of soils that are better suited to crops and are used for crops. This soil is moderately well suited to row crop production of corn and soybeans. It is also suited to small grains and grasses or legumes for hay or pasture. If this soil is used for cultivated crops, there is a hazard of wind erosion. Blowing sand grains sometimes damage newly seeded crops on this soil and on adjoining soils, if the crops are not protected by vegetation. Conservation tillage, which leaves crop residue on the surface throughout the year, and cover crops can reduce soil loss. This soil is generally not well suited to terraces because of the moderately coarse textured material that is difficult to maintain as a terrace ridge and because of the shallowness to the less productive, underlying glacial till. If terraces are used, cuts should be held to a minimum. Droughtiness is a hazard unless rainfall is timely. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

The use of this soil for pasture or hay is also 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 plants. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIe.

412C—Sogn loam, 2 to 9 percent slopes. This is a gently sloping and moderately sloping, somewhat excessively drained soil on convex ridges and side slopes in the uplands. Individual areas are broad and irregular in shape and range from 5 to 40 acres in size.

Typically, the surface soil is very dark brown, friable loam about 14 inches thick. The subsurface layer is underlain by level-bedded, indurated limestone bedrock with dark soil in cracks and crevices.

Included with this soil in mapping are scattered areas where limestone is less than 4 inches beneath the surface or is exposed on the surface as limestone outcrops or shattered fragments. These included areas make up about 5 to 10 percent of this map unit.

Permeability of this Sogn soil is moderate, and surface runoff is medium. The available water capacity is very low. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. Typically, the surface layer is mildly alkaline and seldom needs lime. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in hay and pasture. This soil is generally not suited to cultivated crops. It has a very limited root zone and is droughty. Tillage is very difficult because of the shallow depth to bedrock and because of limestone outcrops on the surface.

This soil is better suited to grasses for hay and pasture. Overgrazing or grazing when the soil is too dry, however, reduces pasture production, resulting in excessive runoff and erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during very dry periods help to keep the pasture and soil in good condition.

This soil is in capability subclass VIIs.

412D—Sogn loam, 9 to 18 percent slopes. This is a strongly sloping and moderately steep, somewhat excessively drained soil on convex side slopes in the uplands. Individual areas are elongated and range from 5 to 15 acres in size.

Typically, the surface layer is very dark brown, friable loam about 8 inches thick. It is underlain by level-bedded, indurated limestone bedrock with dark soil in cracks and crevices. In some places, the surface layer is sandy loam.

Included with this soil in mapping are scattered areas where limestone is less than 4 inches beneath the surface or is exposed on the surface as limestone outcrops or shattered fragments.

Permeability of this Sogn soil is moderate, and surface runoff is rapid. The available water capacity is very low. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is mildly alkaline and seldom needs lime. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in hay and pasture. This soil generally is not suited to cultivated crops. It is better suited to grasses for hay and pasture. It has a very limited root zone and is droughty.

The use of this soil for pasture or hay is effective in controlling erosion. Overgrazing or grazing when the soil is too dry, however, reduces pasture production, resulting in runoff and erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during very dry periods help keep the pasture and soil in good condition.

This soil is in capability subclass VIIs.

428B—Ely silt loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on slightly concave foot slopes on uplands. Individual areas are elongated and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is black, friable silt loam about 7 inches thick. The subsurface layer is black and very dark brown, friable silty clay loam about 25 inches thick. The subsoil is about 25 inches thick. The upper part of the subsoil is dark grayish brown, friable silty clay loam with grayish brown and light olive brown mottles; the middle part is grayish brown, friable silty clay loam with yellowish brown mottles; and the lower part is brown, friable silt loam with yellowish brown mottles. The substratum to a depth of about 60 inches is brown silt loam with yellowish brown mottles. In some places, there are no grayish brown and yellowish brown mottles in the subsoil above a depth of 4 feet.

Included with this soil in mapping are areas adjacent to foot slopes that are underlain by shale at a depth of 3 to 4 feet. These areas are poorly drained and are generally seasonally wet throughout most of the growing season. These included areas make up less than 5 percent of the map unit.

Permeability of this Ely soil is moderate, and surface runoff is medium. This soil has a high water table at a depth of about 2 to 4 feet. The available water capacity is high or very high. The content of organic matter in the surface layer is about 5 to 6 percent. Typically, reaction in the surface layer varies because of previous liming practices. Lime is generally needed if it has not been applied in the past 3 to 5 years. The surface soil is medium acid to slightly acid. The subsoil is neutral to slightly acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Seepage from the uplands keeps this soil wet; tile drainage is needed in most places. In some areas, runoff from the higher lying, cultivated sloping soils creates siltation that may hamper crop production. Diversion terraces may be needed upslope to alleviate this condition. Where this soil is cultivated, the hazard of erosion is slight; therefore, contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, help prevent excessive soil losses. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is in capability subclass IIe.

462B—Downs silt loam, benches, 2 to 7 percent slopes. This is a gently sloping to moderately sloping, well drained soil on loess-covered, convex benches that are along streams and are typically 5 to 10 feet above the flood plain. Individual areas are broad and irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part of the subsoil is brown and yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown mottles. In places, coarse sand is at a depth of 6 or 7 feet. In some small areas, the surface layer is brown.

Permeability of this Downs soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is neutral to slightly acid and needs lime if it has not been applied in the past 3 or 4 years. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops, hay, and pasture. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil is suited to intensive row crops, but it is subject to erosion when cultivated. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. Generally, slopes are uniform enough to be terraced and farmed on the contour. In places, however, terracing can be difficult to install because the length of slope is relatively short. Returning crop residue to the soil or regularly adding other organic materials increases fertility and maintains good tilth.

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

This soil is well suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or harvesting trees.

This soil is in capability subclass IIe.

478G—Nordness-Rock outcrop complex, 18 to 60 percent slopes. This complex consists of steep and very steep, well drained Nordness soils and Rock outcrop on convex side slopes and escarpments. Nordness soils are above and between the outcrops of limestone on the landscape and, less commonly, below them. Rock outcrop is in intermediate and lower positions and is discontinuous. The Nordness soils and the Rock outcrop are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 55 percent Nordness soils, 40 percent Rock outcrop, and 5 percent other soils. The areas are elongated or irregular in shape; some are several miles long. The areas range from 50 to more than 200 acres in size.

Typically, the Nordness soils have a surface layer of very dark gray and very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is dark yellowish brown, friable silty clay loam about 6 inches thick. It is underlain, at a depth of about 13 inches, by hard, fractured limestone.

Typically, Rock outcrop consists of dolomite limestone bedrock. In places, a very thin layer of silt loam or loam covers the bedrock, but in some areas, outcrops of limestone and limestone fragments and boulders cover much of the surface.

Included with this complex in mapping are a few scattered areas of Dubuque soils that have 20 to 30 inches of silty material over bedrock. Also included are a few areas of colluvial soils that have many fragments and chunks of limestone that have slumped from upslope positions. The included soils make up less than 5 percent of the complex.

Permeability of the Nordness soils is moderate, and surface runoff is very rapid. The available water capacity is very low. The content of organic matter is less than 0.5 percent. Typically, the surface layer is neutral to medium acid. The subsoil generally is very low in available phosphorus and potassium.

Most areas are in timber. Many areas, however, are fenced in with surrounding soils and are used as pasture. Nordness soils are not suited to cultivated crops or hay. They are poorly suited to pasture. They have a very limited root zone and are very droughty.

This complex is poorly suited to trees. Most areas remain in native hardwoods, however, because this complex is also poorly suited to pasture. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous in most areas. Special equipment can be used, but with caution. The limestone outcrops also severely restrict the types of equipment that can be used. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. If protected from livestock and fire, wooded areas provide suitable habitat for woodland wildlife.

This complex is in capability subclass VIIs.

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

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 44 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark 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 silt loam.

Permeability of this Orwood soil is moderate, and surface runoff is medium. The available water capacity is high or very high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is neutral. The upper part of the subsoil is medium acid or slightly acid. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Conservation tillage, which leaves crop residue on the surface throughout the year, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long and uniform enough to permit terracing and contour farming. If this soil is terraced, it can be planted to row crops more often than it can with most other conservation practices. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

480C2—Orwood silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, well drained soil on convex, narrow ridges and long side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. There are streaks and pockets of brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 42 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark 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 silt loam.

Included with this soil in mapping are areas of a soil that has a surface layer of yellowish brown loam and is on the upper part of side slopes. In these areas, the content of organic matter is low, the soil tends to dry out quickly, and larger amounts of fertilizer are required. These included areas make up less than 5 percent of this map unit.

Permeability of this Orwood soil is moderate, and surface runoff is medium. The available water capacity is high or very high. The content of organic matter in the surface layer is about 1.5 to 2 percent. Typically, the surface layer is neutral. The upper part of the subsoil is medium acid or slightly acid. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development will be retarded if crusting occurs prior to emergence.

Most areas of this soil are cultivated. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. This soil is very erodible. Conservation tillage, which leaves crop residue on the surface throughout the year, and grassed waterways help to prevent excessive soil loss. In some areas, the slope is long and uniform enough to permit terracing and contour farming. If this soil is terraced, it can be planted to row crops more often than it can with most other conservation practices. More fertilizer is needed on this soil than on the uneroded Orwood soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

480D—Orwood silt loam, 9 to 14 percent slopes. This is a strongly sloping, well drained soil on convex side slopes in the uplands. Individual areas are elongated and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 42 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark yellowish brown and yellowish brown, friable silt loam and loam; and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In some wooded areas, the surface layer is grayish brown.

Permeability of this Orwood soil is moderate, and surface runoff is rapid. The available water capacity is high or very high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is neutral. The subsoil is medium acid or strongly acid. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has good tilth, but tt tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is moderately well suited to occasional row crops, such as corn and soybeans, in rotation with small grains and grasses or legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. This soil is very erodible. Conservation tillage, which leaves crop residue on the surface throughout the year, and grassed waterways help to prevent excessive soil loss. In many areas the slope is long and uniform enough to permit terracing and contour farming. If this soil is terraced, it can be planted to row crops more often than it could be with most other conservation practices. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

480D2—Orwood silt loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, well drained soil on convex side slopes in the uplands. Individual areas are elongated and range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. There are streaks and pockets of brown, friable silt loam where the subsoil material has been mixed into the surface layer by plowing. The subsoil is about 40 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark yellowish brown and yellowish brown, friable silt loam and loam; and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places, the surface layer is grayish brown.

Included with this soil in mapping are a few small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till, are seepy during wet seasons. They are low in fertility. In some areas on the upper part of side slopes, the surface layer is yellowish brown loam. In these areas, the content of organic matter is low, the soil dries quickly, and larger amounts of fertilizer are required. The included areas make up less than 5 percent of this map unit.

Permeability of this Orwood soil is moderate, and surface runoff is rapid. The available water capacity is high or very high. The content of organic matter in the surface layer is about 1.5 to 2 percent. Typically, the surface layer is neutral. The subsoil is medium acid or strongly acid. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are cultivated. This soil is moderately well suited to occasional row crops of corn and soybeans in rotation with small grains and grasses or legumes for hay or pasture. If this soil is used for cultivated crops, there is a hazard of erosion. This soil is very erodible. Conservation tillage, which leaves crop residue on the surface throughout the year, and grassed waterways help to prevent excessive soil loss. In many areas, the slope is long and uniform enough to permit terracing and contour farming. If this soil is terraced, it can be planted to row crops more often than it could be with most other conservation practices. More fertilizer is needed on this soil than on the uneroded Orwood soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

480F2—Orwood silt loam, 14 to 25 percent slopes, moderately eroded. This is a moderately steep and steep, well drained soil on convex, short side slopes in the uplands. Individual areas are elongated and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. There are streaks and pockets of dark yellowish brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 36 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam and loam, and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In some wooded areas, the surface layer is grayish brown.

Included with this soil in mapping are a few small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till, are seepy during wet weasons. They are low in fertility. In some areas on the upper part of side slopes, the surface layer is yellowish brown loam. In these areas the content of organic matter is low, the soil dries quickly, and larger amounts of fertilizer are required. The included areas make up 5 to 10 percent of this map unit.

Permeability of this Orwood soil is moderate, and surface runoff is rapid. The available water capacity is high or very high. The content of organic matter in the surface layer is about 1 to 1.5 percent. Typically, the surface layer is neutral. The upper part of the subsoil is medium acid or strongly acid. The subsoil generally has a medium supply of available phosphorus and a low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Many areas of this soil are in cultivated crops although some areas have been returned to pasture. This soil generally is not suited to corn or soybeans. If this soil is used for cultivated crops, there is a hazard of erosion. This soil is very erodible. Conservation tillage, which leaves crop residue on the surface throughout the year, and grassed waterways help to prevent excessive soil loss. In some areas, the soil can be terraced along with the less sloping soils upslope. More fertilizer is needed on this soil than on the uneroded Orwood soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Competing vegetation needs to be controlled by site preparation or by spraying or cutting.

This soil is in capability subclass VIe.

482B—Racine loam, 2 to 5 percent slopes. This is a gently sloping, well drained soil on convex, intermediate ridgetops in the uplands. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is very dark brown, friable loam about 9 inches thick. The subsurface layer is brown, friable loam about 5 inches thick. The subsoil is about 40 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable loam and sandy clay loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray and strong brown mottles in the lower part.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. In some areas the surface layer is gravelly loamy sand or gravelly sandy loam. These areas are droughty and are low in organic matter content. The included areas make up less than 5 percent of this map unit.

Permeability of this Racine soil is moderate. This soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, reaction varies widely in the surface layer as a result of local liming practices. The soil is neutral or slightly acid to a depth of about 20 inches; it is medium acid or strongly acid at a depth of about 33 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses or legumes for hay and pasture. If this soil is used for cultivated crops, supplemental drainage is seldom needed, but there is a hazard of erosion. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss. In many areas, slopes are long and smooth enough to permit terracing and contour farming. If terraced, cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till, which is low in fertility. Stones from the subsoil may interfere with some tillage operations. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIe.

482C—Racine loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on convex, intermediate ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to more than 60 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable loam and sandy clay loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray and strong brown mottles in the lower part.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. Also, in some areas the surface layer is gravelly loamy sand or gravelly sandy loam. In these areas the soil is droughty and the content of organic matter is low. These included areas make up about 5 to 10 percent of this map unit.

Permeability of this Racine soil is moderate. This soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 2 to 2.5 percent. Typically, reaction varies widely in the surface layer as a result of local liming practices. The soil is neutral or slightly acid to a depth of about 20 inches; it is medium acid or strongly acid at a depth of about 33 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, supplemental drainage is seldom needed, but there is a hazard of erosion. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terraces can reduce soil loss (fig. 11). In many areas, slopes are long and smooth enough to permit terracing and contour farming. If this soil is terraced, cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till, which is low in fertility. Stones from the subsoil may interfere with some tillage operations. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

482C2—Racine loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, well drained soil on convex, intermediate ridges and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to more than 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. There are streaks and pockets of brown, friable loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 37 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable loam and sandy clay loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray and strong brown mottles in the lower part. In places, the surface layer is brown, friable loam.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. Also, in some areas the surface layer is gravelly loamy sand or gravelly sandy loam. In these areas the soil is droughty, and the content or organic matter is low. These included areas make up about 5 to 10 percent of this map unit.

Permeability of this Racine soil is moderate. This soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, reaction varies widely in the surface layer as a result of local liming practices. The soil is neutral or slightly acid to a depth of about 20 inches and is medium acid or strongly acid at a depth of about 33 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The

Figure 11.—Contour stripcropping on moderately sloping Racine soils. Corn and hay are grown for dairy and hog operations nearby.

surface layer of this soil has fair tilth. It tends to crust after hard rains and to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses or legumes for hay and pasture. If this soil is used for cultivated crops, supplemental drainage is seldom needed, but there is a hazard of erosion. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terracing can reduce soil loss. In many areas slopes are long and smooth enough to permit terracing and contour farming If this soil is terraced, cuts should be held to a minimum to avoid unnecessary exposure of the less productive underlying glacial till, which is low in fertility. Stones from the subsoil may interfere with some tillage operations. More fertilizer is needed on this soil than on the uneroded Racine soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

482D2—Racine loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, well drained soil on convex side slopes in the uplands. Individual areas are irregular in shape and range from 10 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. There are streaks and pockets of brown, friable loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 33 inches thick. The upper part of the subsoil is brown and dark yellowish brown, friable loam and sandy clay loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray and strong brown mottles. In places, the surface soil is very dark grayish brown and brown, friable loam about 11 inches thick.

Included with this soil in mapping are small scattered areas where the surface layer is loamy sand or sand. In other areas, the surface layer is gravelly loamy sand or gravelly sandy loam. In these areas the soil is droughty and the content of organic matter is low. Also included are small areas where glacial till outcrops. These outcrops are low in fertility and are less productive and may develop wet and seepy areas in some years. These included areas make up about 5 to 10 percent of this map unit.

Permeability of this Racine soil is moderate. This soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 or 2 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. The soil is neutral or slightly acid to a depth of about 14 inches; it is medium acid or strongly acid at a depth of about 27 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has fair tilth. It tends to crust after hard rains and to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, supplemental drainage is seldom needed, but there is a hazard of erosion. Contour stripcropping; conservation tillage, which leaves crop residue on the surface throughout the year; and terracing can reduce soil loss. In many areas slopes are long and smooth enough to permit terracing and contour farming. If the soil is terraced, cuts should be held to a minimum to avoid unnecessary exposure of the less productive, underlying glacial till, which is low in fertility. Stones from the subsoil may interfere with some tillage operations. More fertilizer is needed on this soil than on uneroded Racine soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings or competition from undesirable plants should not be a problem.

This soil is in capability subclass IVe.

482F2—Racine loam, 14 to 25 percent slopes, moderately eroded. This is a steep, well drained soil on convex side slopes on uplands. Individual areas are irregular in shape and range from 5 to more than 60 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 6 inches thick. There are streaks and pockets of brown, friable loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 30 inches thick. The upper part is brown and dark yellowish brown, friable loam and sandy clay loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown loam with light brownish gray and strong brown mottles. In some wooded areas, the surface layer is grayish brown and brown.

Included with this soil in mapping are small areas where the surface layer is loamy sand, sand, or gravelly sand. In these areas, the soil is droughty and the content of organic matter is low. Also included are small areas of glacial till outcrops. These areas are low in fertility and are less productive. In some years, there are wet and seepy areas in these areas. The included areas make up about 5 to 10 percent of this map unit.

Permeability of this Racine soil is moderate. This soil is more permeable in the upper part of the subsoil than in the lower part of the subsoil and the substratum. Surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is 0.5 to 1 percent. Typically, reaction in the surface layer varies widely as a result of local liming practices. This soil is neutral or slightly acid to a depth of about 12 inches; it is medium acid or strongly acid at a depth of about 25 inches. The subsoil generally has a very low supply of available phosphorus and potassium. The surface layer of this soil has fair tilth. It tends to crust after hard rains and to puddle if worked when it is wet.

Most areas of this soil are in hay or pasture. This soil generally is not suited to cultivated crops. It is better suited to grasses and legumes. The operation of farm machinery is difficult on this soil because of the steep slope and the presence of gullies and drainageways. If this soil is used for cultivated crops, it is subject to severe erosion. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. Because the slope is steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Survival of seedlings or competition from undesirable plants should not be a problem.

This soil is in capability subclass VIe.

485—Spillville loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on bottom lands along small rivers and large streams. This soil is occasionally flooded. Individual areas are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface soil is black, friable loam about 40 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown loam. In some small areas there is 6 to 18 inches of lighter colored overwash.

Included with this soil in mapping are small scattered sandy areas. These areas are lower in organic matter content and fertility than the Spillville soil. These included areas make up less than 5 percent of this map unit.

Permeability of this Spillville soil is moderate, and surface runoff is slow. This soil has a seasonal high water table at a depth of 3 to 5 feet. The available water capacity is high. The content of organic matter in the surface layer is about 4 to 6 percent. Typically, the surface layer is neutral or slightly acid. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. A few areas are in permanent pasture. If it is protected from flooding, this soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil is subject to flooding during periods of heavy rainfall. Yields may vary considerably from year to year, depending on the frequency and time of year of flooding. Diversion terraces may be needed in some areas for flood protection. The need for flood protection varies in each area because the deepening and straightening of stream channels and the construction of roads and road ditches can affect the flooding pattern or reduce the hazard.

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

This soil is in capability subclass IIw.

487B—Otter-Worthen silt loams, 2 to 5 percent slopes. This complex consists of gently sloping soils in upland drainageways below more sloping, loess-covered upland soils. The Otter soil is poorly drained. It ponds water and is frequently flooded for brief periods. It is near the drainageways, which generally are U-shaped and are 150 to 300 feet wide. The Worthen soil is well drained. It is on foot slopes directly below more sloping upland side slopes. The Otter and Worthen soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 55 percent Otter soil and 40 percent Worthen soil. Individual areas are long and range from 20 to 70 acres in size.

Typically, the surface layer of the Otter soil is black, friable silt loam about 10 inches thick. The subsurface layer is black and very dark gray, friable silt loam about 24 inches thick. The substratum to a depth of about 60 inches is dark gray silt loam. In some places the surface layer is stratified dark grayish brown and grayish brown, friable silt loam about 8 inches thick.

Typically, the surface layer of the Worthen soil is black and very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is very dark brown and very dark grayish brown, friable silt loam about 18 inches thick. The subsoil is about 24 inches thick. The upper part is brown, friable silt loam, and the lower part is yellowish brown, friable silt loam with grayish brown and yellowish brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam.

Included with these soils in mapping are areas of Orion soils along the lower part of drainageways. The Orion soils formed in 20 to 40 inches of recent stratified sediment underlain by an older buried soil. They are lower in organic matter content than Otter and Worthen soils. These included soils make up less than 5 percent of this map unit.

Permeability of the Otter and Worthen soils is moderate. Surface runoff is very low on the Otter soil and medium on the Worthen soil. The Otter soil has a seasonal high water table at or above the surface. The available water capacity of both soils is very high. The content of organic matter in the surface layer of the Otter soil is about 6 to 7 percent, and in the Worthen soil it is about 3 to 4 percent. Typically, the surface layer of both soils is neutral to slightly acid. The subsoil of the Worthen soil is slightly acid. The subsoil of the Otter soil generally is low in available phosphorus and very low in available potassium. The subsoil of the Worthen soil generally is medium in available phosphorus and very low in available potassium. The Otter soil has fair tilth, but it tends to puddle if worked when it is wet and to become hard and cloddy when it is dry. The Worthen soil has good tilth, but it tends to puddle if worked when it is wet.

Many areas of these soils are in permanent pasture. In some areas, the soils are cropped with surrounding soils because individual areas are generally too small to be cropped separately. If the Otter soil is artificially drained and protected from overflow, it is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The Otter soil is susceptible to overflow from more sloping soils upslope during periods of high rainfall, and crop damage can result in some years. Diversion terraces are needed to prevent crop damage. The Otter soil is wet as a result of overflow, slow runoff, and a high water table. Tile functions well in most areas if proper outlets are available.

The Worthen soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It receives runoff from the more sloping soils upslope. Erosion is a slight hazard in cultivated areas. Conservation tillage, which leaves crop residue on the surface throughout the year, helps prevent excessive soil loss.

Many areas of the Otter soil that are subject to frequent overflow are used for pasture. Overgrazing or grazing during wet periods causes excessive puddling. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

These soils are in capability subclass IIIw.

488C2—Newvienna silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, moderately well drained soil at the head of drainageways and on convex side slopes along drainageways in the uplands. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. There are pockets of brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 31 inches thick. The upper part is brown and dark brown, friable silty clay loam; the middle part is brown, friable silty clay loam with strong brown and yellowish brown mottles; and the lower part is mottled grayish brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray silt loam with strong brown mottles. In some small areas, the surface layer is thicker than is typical.

Included with this soil in mapping are areas, on the upper part of side slopes, where the surface layer is brown silty clay loam with strong brown and yellowish brown mottles. In these areas the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. These included areas make up less than 5 percent of this map unit.

Permeability of this Newvienna soil is moderate, and surface runoff is medium. This soil typically has a seasonal high water table at a depth of 2.5 to 4 feet. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is neutral or slightly acid but varies as a result of local liming practices. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas slopes are long and smooth enough to permit terracing and contour farming. A perched water table causes drainageways and the lower part of side slopes to be wet and seepy during spring. A tile system and terraces are a good combination on this soil. Tile drainage is needed if this soil is farmed with the better drained adjacent soils in the same field. Returning crop residue to the soil or regularly adding other organic materials increases fertility and the infiltration of water and improves soil tilth.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

488D2—Newvienna silt loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, moderately well drained soil at the head of drainageways and on convex side slopes along drainageways in the uplands. Individual areas are irregular in shape and range from 10 to 60 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. It has pockets of brown, friable silt loam subsoil material. The subsoil is about 28 inches thick. The upper part is brown and dark brown, friable silty clay loam; the middle part is brown, friable silty clay loam with strong brown and yellowish brown mottles; and the lower part is mottled grayish brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray silt loam with strong brown mottles.

Included with this soil in mapping are small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till and are low in fertility, cause the surrounding Newvienna soil to be seepy and wet for long periods. Also included are some areas, on the upper part of side slopes, where the surface layer is brown silty clay loam with strong brown and yellowish brown mottles. In these areas, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. The included soils make up less than 5 percent of the map unit.

Permeability of this Newvienna soil is moderate, and surface runoff is rapid. This soil has a seasonal high water table at a depth of 2.5 to 4 feet. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is acid if lime has not been applied in the past 3 or 4 years. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in cultivated crops in rotation with hay. This soil is moderately well suited to occasional crops of corn and small grains but is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to further erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, slopes are long and smooth enough to permit terracing and contour farming. A perched water table causes drainageways and the lower part of side slopes to be wet and seepy during spring. A tile system and terraces are a good combination on this soil. Tile drainage is needed if this soil is farmed with the better drained adjacent soils in the same field. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases the infiltration of water.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

490—Caneek silt loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on the lower part of wide bottom lands along major streams. This soil is frequently flooded for very brief periods. Individual areas are broad and elongated. Some are about a mile long. The areas range from 30 to more than 50 acres in size.

Typically, the surface layer is about 10 inches thick. It is dark grayish brown and grayish brown, friable silt loam with brown mottles. The next layer, about 30 inches thick, is stratified grayish brown, dark gray, gray, and olive gray, friable silt loam with reddish brown mottles. It formed in recently deposited sediment. The underlying material to a depth of about 60 inches is a buried surface layer of black silty clay loam. In some places, the buried underlying material is as deep as 55 inches.

Permeability of this Caneek soil is moderate, and surface runoff is slow. The soil has a seasonal high water table at a depth of 1 to 3 feet. The available water capacity is very high. Water may be ponded during wet periods. The content of organic matter in the surface layer is about 0.5 to 1 percent.

Typically, reaction is mildly alkaline in the silty sediment and neutral in the buried surface layer. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It dries out slowly after rainfall. The surface layer has a tendency to puddle if worked when it is wet or to crust after heavy rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in permanent pasture or are idle, brushy land. A few areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture if it is artificially drained and protected from flooding. This soil is wet as a result of flooding, slow runoff, and a seasonal high water table. Tile functions well in this soil if proper outlets are available. Because of the high velocity runoff during periods of heavy rainfall, crops can be damaged in some years. Diversion terraces upslope help prevent flooding.

Areas that are flooded frequently are used mainly for pasture. Overgrazing or grazing during wet periods causes surface compaction and excessive puddling of the soil. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is in capability subclass IIIw.

496B—Dorchester-Volney complex, 2 to 5 percent slopes. This complex consists of gently sloping, moderately well drained and well drained soils on alluvial fans and in the lower part of narrow drainageways below the steep, thin, loess-covered uplands. The drainageways are dry most of the year, but high-velocity stream flooding occurs during heavy rainfall for short periods. The Dorchester soil is along stream channels and on the lower part of side slopes, and the Volney soil is below steep upland hillsides. The Dorchester and Volney soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 50 percent Dorchester soil and 40 percent Volney soil. Individual areas are elongated and narrow; some are a couple of miles long. The areas range from 10 to 40 acres in size.

Typically, the Dorchester soil has a surface layer of stratified, dark grayish brown and very dark grayish brown, friable silt loam about 7 inches thick. The next layer is a stratified substratum of dark grayish brown and brown, friable silt loam with grayish brown mottles in the lower part. The underlying material is a buried surface layer of black silt loam with yellowish brown mottles in the upper part. In some places, reaction in the surface layer is neutral.

Typically, the Volney soil has a surface layer of very dark grayish brown, friable channery silt loam about 9 inches thick. The subsurface layer is very dark brown, friable channery silt loam about 17 inches thick. Both of these layers are 15 percent coarse limestone fragments. The substratum to a depth of about 60 inches is dominantly coarse fragments of limestone interbedded with very dark brown silt loam.

Included with these soils in mapping are small areas of Caneek soils. Caneek soils are poorly drained and have a seasonal high water table. They are in depressional swales and oxbows. The included soils make up less than 10 percent of this map unit.

Permeability of the Dorchester soil is moderate, and permeability of the Volney soil is moderately rapid. Surface runoff is slow on the Dorchester soil and medium on the Volney soil. The available water capacity of the Dorchester soil is very high, and that of the Volney soil is low to moderate. The content of organic matter in the surface layer of the Dorchester soil is about 0.5 to 1 percent, and it is 3 to 5 percent in the Volney soil. Typically, the surface layer of these soils is mildly alkaline to moderately alkaline. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. Dorchester and Volney soils have fair tilth. If the Dorchester soil is cultivated, it has a tendency to puddle if worked when it is wet or to crust after heavy rains. The Volney soil has poor tilth. The coarse limestone fragments in the surface layer generally make cultivation difficult.

Most areas of these soils are in permanent pasture or trees. The soils generally are not suited to corn, soybeans, or small grains and are poorly suited to grasses and legumes for hay. They are subject to occasional high-velocity runoff from the steep and very steep soils upslope. Young crops on these soils can be covered by sediment. In some areas, runoff deposits new sediment containing limestone fragments, which interfere with farming operations. In addition, because these soils are located below very steep soils, most areas are very difficult to reach with ordinary farm machinery. In some areas, properly placed diversions can help protect the soils from local runoff.

The soils in this complex are suited to pasture. The grasses, however, are subject to high-velocity runoff during periods of heavy rainfall and can be covered by sediment. Grazing during wet periods causes surface compaction and increases runoff. Grazing capacity of the soils is generally low, because many areas are not readily accessible and little fertilizer can be applied. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help prevent further damage to the pasture and soil.

These soils are suited to trees, and most areas remain in native hardwoods. Natural and planted seedlings do not survive well. Seedlings can be spaced close together when planting. The surviving trees can be thinned later to achieve the desired stand density. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. There are no hazards or limitations in planting or harvesting trees.

The soils in this complex are in capability subclass VIs.

497F—Fayette-Dubuque-Schapville silt loams, 18 to 30 percent slopes. This complex consists of steep and very steep soils on uplands dissected by many small drainageways and gullies. The Fayette soil formed in loess and is well drained. It is on convex side slopes. The Dubuque soil formed in loess over limestone, and it also is well drained. It is near the base of slopes. The Schapville soil formed in clayey shale and is moderately well drained. It is on escarpments along drainageways and springs. These soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 50 percent Fayette soil, 20 percent Dubuque soil, and 20 percent Schapville soil. Individual areas are irregular in shape; some are more than a mile long. The areas range from 15 to more than 100 acres in size.

Typically, the surface layer of the Fayette soil is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable silty clay loam, and the lower part is light yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown mottles. In some places, there are mottles within 30 inches of the surface, and shale is at a depth of about 4 to 6 feet.

Typically, the surface layer of the Dubuque soil is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 18 inches thick. The upper part is dark yellowish brown, friable silty clay loam, and the lower part is reddish brown, firm silty clay loam. The subsoil is underlain at a depth of about 26 inches by hard, fractured limestone.

Typically, the surface layer of the Schapville soil is black, friable silt loam about 7 inches thick. The subsurface layer is black, friable silt loam about 7 inches thick. The subsoil is about 9 inches thick. The upper part is very dark gray, friable silty clay loam with olive brown mottles, and the lower part is light olive brown, firm silty clay loam with grayish brown and yellowish brown mottles. Mottled light yellowish brown and light gray, clayey calcareous shale is at a depth of about 23 inches.

Included with these soils in mapping are small areas of Nordness soils. Nordness soils have limestone bedrock at a depth of less than 18 inches. They are at the base of slopes. Also included are scattered areas where limestone boulders protrude about 3 to 5 feet at the surface and rest on shale bedrock, which is at a depth of 8 to 10 feet. The limestone boulders are approximately 10 to 20 feet in diameter. The included areas make up about 10 percent of this map unit.

Fayette and Dubuque soils are moderately permeable. The Schapville soil is moderately permeable in the surface layer and subsoil and very slowly permeable in the clayey calcareous shale. The Schapville soil has a seasonal high water table at a depth of 2.5 to 5 feet. Surface runoff on these soils is rapid. The available water capacity of the Fayette soil is high, that of the Schapville soil is moderate, and that of the Dubuque soil is low. The content of organic matter in the surface layer of Fayette and Dubuque soils is about 1 to 2 percent, and it is about 3 to 4 percent in the Schapville soil. Typically, the surface layer of the Fayette soil is slightly acid or medium acid, and the upper part of the subsoil is strongly acid; the surface layer of the Dubuque soil is slightly acid, and the subsoil is medium acid; and the surface layer of the Schapville soil is neutral, and the subsoil is mildly alkaline. Generally, the subsoil of the Fayette soil has a high supply of available phosphorus and a very low supply of available potassium; the subsoil of the Dubuque soil has a medium supply of available phosphorus and a very low supply of available potassium; and the subsoil of the Schapville soil has a low supply of available phosphorus and potassium. Fayette and Dubuque soils have fair tilth, and the Schapville soil has good tilth. If cultivated, these soils have a tendency to puddle if worked when they are wet. Fayette and Dubuque soils tend to crust after heavy rains.

Most areas of these soils are in permanent pasture or trees. These soils are not suited to corn, soybeans, oats, or hay. They generally are not suited to cultivation and are subject to severe erosion if cultivated. The operation of farm machinery is difficult on these soils because of the steep slopes and the many small drainageways and gullies. Some areas receive water from small springs and consequently are very wet and seepy. In many areas, there are limestone boulders on the surface. The boulders have rolled downslope from higher lying areas. They make cultivation extremely difficult.

The soils are poorly suited to pasture. Because of the difficulty in applying lime and fertilizer on these steep soils, yields and the carrying capacity of the soils are low. Grazing is restricted. Overgrazing or grazing when the soils are very wet causes surface compaction and increased runoff.

These soils are suited to trees, and many areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

The soils making up this complex are in capability subclass VIIe.

499D—Nordness silt loam, 9 to 18 percent slopes. This is a strongly sloping and moderately steep, well drained soil on convex ridges and side slopes on uplands. Individual areas are elongated or irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is brown, friable silty clay loam about 7 inches thick. The subsoil is underlain, at a depth of about 16 inches, by hard, fractured limestone. In some places, the surface layer is very dark brown, friable loam.

Included with this soil in mapping are a few sinkholes that are about 10 to 20 feet in diameter. These sinkholes are caused by the internal erosion of limestone bedrock. Also included are areas of open pits or remnants of lead mines. Most of the mines are 5 to 10 feet in diameter and 10 to 40 feet deep. They are 20 to 50 feet apart in some areas. The included areas make up less than 5 percent of this map unit.

Permeability of this Nordness soil is moderate, and surface runoff is rapid. The available water capacity is very low. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is neutral to medium acid but varies because of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are in pasture and timber. Although a few small areas are in cultivated crops, the soil is better suited to grasses for hay and pasture. If cultivated, this soil is subject to erosion. It also has a very limited root zone and is droughty. Tillage operations are very difficult because of the shallowness to bedrock and the limestone outcrops.

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

This soil is suited to trees, and many areas remain in native hardwoods. Because erosion is a hazard, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Seedlings do not survive well. They can be planted closer together to achieve the desired stand density. Natural and planted seedlings grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIs.

499F—Nordness silt loam, 18 to 35 percent slopes. This is a steep and very steep, well drained soil on convex side slopes and escarpments on uplands. Individual areas are elongated and irregular in shape and range from 50 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is brown, friable silty clay loam about 4 inches thick. It is underlain, at a depth of about 13 inches, by hard, fractured limestone bedrock. In a few areas, the depth to limestone bedrock is as little as 6 inches. Also, in some areas the limestone crops out.

Permeability of this Nordness soil is moderate, and surface runoff is rapid. The available water capacity is very low. The content of organic matter in the surface layer is less than 0.5 percent. Typically, the surface layer is neutral to medium acid but varies because of local liming practices. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are in pasture or timber. This soil is not suited to cultivated crops. It is better suited to trees or to grasses for pasture. This soil is subject to severe erosion if it is not protected by vegetation. Also, it has a very limited root zone and is droughty. If this soil is used for hay, harvesting operations are difficult because of the outcrops of limestone in some areas and the steep slopes.

The use of this soil for pasture is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and, eventually, severe erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet and very dry periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and most areas remain in native hardwoods. Because erosion is a hazard, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. Because this soil is steep, there is some risk involved in operating equipment. Special equipment can be used, and caution should be exercised in its operation. Seedlings do not survive well. They can be spaced closer together to achieve the desired stand density. Natural and planted seedlings grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIIs.

512D—Marlean sandy loam, 5 to 14 percent slopes. This is a moderately sloping to strongly sloping, excessively drained soil on ridges and convex side slopes on uplands. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is very dark brown, friable sandy loam about 8 inches thick. The subsurface layer is black, friable sandy loam about 6 inches thick; it is about 10 percent chert fragments. The substratum to a depth of about 60 inches is dark grayish brown, extremely cobbly sandy loam interbedded with about 75 percent 1- to 6-inch disjointed chert and limestone fragments. In some places, the surface layer is friable loam.

Included with this soil in mapping are small scattered areas of a soil that has a sandy surface layer. That soil has a lower available water capacity than the Marlean soil, and it is acid and less productive. Also included are small areas of Rollingstone soils on ridges. Rollingstone soils formed in cherty clayey residuum; they have slow permeability. The included soils make up about 10 to 15 percent of the map unit.

Permeability of this Marlean soil is moderately rapid. Surface runoff is rapid. The available water capacity is very low. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is neutral or slightly acid. The substratum is mildly alkaline. The subsoil or substratum generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are in hay. If this soil is cultivated, it is farmed with adjacent soils in a rotation of corn, oats, and hay. This soil is not suited to corn, soybeans, and small grains. It is better suited to grasses and legumes for hay and pasture. This soil is very droughty and is subject to wind and water erosion if it is cultivated. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil erosion and conserve moisture. Returning crop residue to the soil or regularly adding other organic material increases fertility and improves tilth.

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

This soil is in capability subclass VIs.

520—Coppock silt loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low stream terraces. This soil is rarely flooded but receives runoff from soils on uplands. Individual areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 9 inches thick. The subsurface layer is brown and dark grayish brown, friable silt loam about 8 inches thick. It has yellowish brown mottles. The subsoil extends to a depth of 60 inches or more. The upper part of the subsoil is grayish brown, friable silt loam with yellowish brown mottles; the middle part is grayish brown and light brownish gray, friable silt loam with yellowish brown and strong brown mottles; and the lower part is mottled gray and brown, friable silt loam.

Permeability of this Coppock soil is moderate. Surface runoff is slow and tends to pond water. This soil has a seasonal high water table at a depth of 1 foot to 3 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is slightly acid or neutral. The upper part of the subsoil is medium acid or strongly acid. The subsoil generally is low or medium in available phosphorus and very low in available potassium. This soil has good tilth, but it tends to puddle if worked when it is wet. This soil generally crusts after hard rains if the platy subsurface layers have been mixed into the plow layer during cultivation.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil receives runoff from soils on uplands. Diversion terraces placed on adjacent upland slopes may be needed to protect the soil from overflow and siltation. This soil is slightly wet, and tile drainage generally is needed to improve the timeliness of field operations. Tile drainage can be used for continuous row crops, and the erosion hazard is minimal. Conservation tillage, which leaves crop residue on the surface throughout the year, helps prevent soil loss. Returning crop residue to the soil or regularly adding other organic material increases fertility.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Because this soil is somewhat poorly drained, the use of equipment generally is restricted to the drier times of the year or to winter when the ground is frozen. Special high flotation equipment can be used for harvesting or managing the soil during wet periods. Natural and planted seedlings survive well. Competing vegetation needs to be controlled by site preparation or by spraying or cutting. Erosion is not a limiting factor on this soil during logging and related road construction.

This soil is in capability subclass IIw.

563D—Rozetta-Eleroy silt loams, 9 to 14 percent slopes. This complex consists of strongly sloping, moderately well drained soils on convex side slopes on uplands. The Rozetta soil is on the upper part of side slopes and narrow ridges, and the Eleroy soil is on the lower part of side slopes adjacent to nearby drainageways. The Rozetta and Eleroy soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 70 percent Rozetta soil and 25 percent Eleroy soil. Individual areas of this complex are irregular in shape or are finger-shaped and range from 5 to 30 acres in size.

Typically, the surface layer of the Rozetta soil is vary dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the middle part is dark yellowish brown and yellowish brown, friable silty clay loam with grayish brown mottles; and the lower part is mottled grayish brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray silt loam with yellowish brown mottles. Typically, shale bedrock is at a depth of 8 or 9 feet.

Typically, the surface layer of the Eleroy soil is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 4 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam; the middle part is yellowish brown, friable silty clay loam with pale brown mottles; and the lower part is mottled pale brown, light olive brown, and yellowish brown, friable silty clay loam. The substratum to a depth of about 47 inches is brown silty clay loam with chert fragments. The substratum is underlain by greenish gray and pale olive, calcareous clayey shale.

Included with these soils in mapping are areas where a few limestone boulders about 10 feet across are exposed at the surface. These outcrops are scattered throughout the areas of this map unit. They dislodged from the upper limestone formation and rest on the shale. The outcrops hinder tillage. Generally, there is not enough soil material over the limestone to support vegetation. Also included are residential and industrial areas surrounding the city of Dubuque. In these areas, the soil has been excavated, leveled, filled, built up, or smoothed to fit construction needs. The included areas make up less than 5 percent of the complex.

Permeability of the Rozetta and Eleroy soils is moderate, but permeability of the underlying shale in the Eleroy soil is very slow. Surface runoff is rapid. These soils have a seasonal high water table at a depth of about 2.5 to 5 feet. These soils also tend to perch water at the shale contact, which causes nearby drainageways to be wet and seepy. Typically, fragments of limestone separate the silty material from the underlying firm shale. The available water capacity is high in both soils. The content of organic matter in the surface layer of both soils is about 1 to 2 percent. Typically, the surface layer of both soils is neutral to medium acid but varies as a result of local liming practices. The subsoil is medium acid to neutral. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. These soils generally have fair tilth. They tend to puddle if worked when they are wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of these soils are in timber, but some areas are in pasture. A few areas are used as residential sites, because they offer a scenic view. These soils are suited to occasional corn in rotation with small grains and to grasses and legumes for hay and pasture. If these soils are used for cultivated crops, they are subject to erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, slopes are long and smooth enough to permit terracing and contour farming. A perched water table and underground springs at or near the limestone escarpment upslope cause some drainageways to be seasonally wet for long periods. Proper tile placement is necessary to drain these seepy areas and to facilitate timely field operations. A tile system and terraces are a good combination on these soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

The use of these soils for pasture or hay is effective in controlling erosion. Because there is a perched water table, some legumes are subject to winterkill. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are well suited to trees, and most areas still remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This complex is in capability subclass IIIe.

563D2—Rozetta-Eleroy silt loams, 9 to 14 percent slopes, moderately eroded. This complex consists of strongly sloping, moderately well drained soils on convex side slopes on uplands. The Rozetta soil is on the upper part of side slopes and narrow ridges, and the Eleroy soil is on the lower part of side slopes adjacent to nearby drainageways. The Rozetta and Eleroy soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 70 percent Rozetta soil and 25 percent Eleroy soil. Individual areas of this complex are irregular in shape or are finger-shaped and range from 25 to 50 acres in size.

Typically, the surface layer of the Rozetta soil is brown and dark brown, friable silt loam about 7 inches thick. It has pockets of dark yellowish brown, friable silty clay loam, which is part of the subsoil. The subsoil is about 36 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam; the middle part is dark yellowish brown and yellowish brown, friable silty clay loam with grayish brown mottles; and the lower part is mottled grayish brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is light brownish gray silt loam with yellowish brown mottles. Typically, shale is at a depth of 8 or 9 feet.

Typically, the surface layer of the Eleroy soil is grayish brown and dark grayish brown, friable silt loam about 7 inches thick. It has pockets of yellowish brown, friable silty clay loam, which is part of the subsoil. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable silty clay loam; the middle part is yellowish brown, friable silty clay loam with pale brown mottles; and the lower part is mottled pale brown, yellowish brown, and light olive brown, friable silty clay loam. The substratum to a depth of about 44 inches is brown silty clay loam with chert fragments. The substratum is underlain by greenish gray and pale olive, calcareous, clayey shale.

Included with these soils in mapping are a few areas where limestone boulders about 10 feet across are exposed at the surface. These outcrops are scattered throughout. They dislodged from the upper limestone formation and rest on the shale. Also, in some areas on the upper part of side slopes, the surface layer is yellowish brown silty clay loam. In these areas, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. Also included are residential and industrial areas surrounding the city of Dubuque. In these areas, the soil has been excavated, leveled, filled, built up, or smoothed to fit construction needs. The included areas make up less than 5 percent of the complex.

Permeability of the Rozetta and Eleroy soils is moderate, but permeability of the underlying shale in the Eleroy soil is very slow. Surface runoff is rapid. These soils have a seasonal high water table at a depth of about 2.5 to 5 feet. These soils also tend to perch water at the shale contact, which causes nearby drainageways to be wet and seepy. Typically, fragments of limestone separate the firm shale material from the overlying silty material. The available water capacity in both soils is high. The content of organic matter in the surface layer of both soils is about 0.5 to 1 percent. Typically, the surface layer of both soils is neutral to medium acid but varies as a result of local liming practices. The subsoil is medium acid to neutral. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. These soils generally have fair tilth. They tend to puddle if worked when they are wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of these soils are in cultivated crops in rotation with hay, but some areas are in pasture. A few areas are used as residential sites because they offer a scenic view. These soils are suited to occasional corn in rotation with small grains and to grasses and legumes for hay and pasture. If these soils are used for cultivated crops, they are subject to erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In many areas, slopes are long and smooth enough to permit terracing and contour farming. A perched water table and underground springs at or near limestone escarpments cause some drainageways to be seasonally wet for long periods. Proper tile placement is necessary to drain these seepy areas and to facilitate timely field operations. A tile system and terraces are a good combination on these soils. Larger amounts of fertilizer are needed on these soils than on the uneroded Rozetta and Eleroy soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

The use of these soils for pasture or hay is effective in controlling erosion. Because there is a perched water table, some legumes may be subject to winterkill. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by girdling. There are no hazards or limitations in planting or harvesting trees.

This complex is in capability subclass IIIe.

563E—Rozetta-Eleroy silt loams, 14 to 18 percent slopes. This complex consists of moderately steep, moderately well drained soils on convex side slopes on uplands. The Rozetta soil is on the upper part of side slopes, and the Eleroy soil is on the lower part of side slopes adjacent to nearby drainageways. The Rozetta and Eleroy soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 65 percent Rozetta soil and 30 percent Eleroy soil. Individual areas of this complex are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer of the Rozetta soil is very dark brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable silty clay loam; the middle part is mottled yellowish brown and pale brown, friable silty clay loam; and the lower part is mottled brown and light brownish gray, friable silty clay loam.

The substratum to a depth of about 60 inches is mottled light brownish gray and yellowish brown silt loam. Typically, shale is at a depth of 6 or 7 feet.

Typically, the surface layer of the Eleroy soil is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 3 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, friable silty clay loam; the middle part is yellowish brown, friable silty clay loam with pale brown mottles; and the lower part is mottled pale brown, yellowish brown, and light olive brown, friable silty clay loam. The substratum to a depth of about 43 inches is brown silty clay locm with chert fragments. The substratum is underlain by greenish gray and pale olive, calcareous clayey shale.

Included with these soils in mapping are a few small areas of shale outcrops. These outcrops are on the lower part of side slopes. The areas are wet and seepy and are low in fertility. In these areas, seeding is difficult to establish without properly installed interceptor tile drainage and without additional fertilizer applications. Also included are areas where a few limestone boulders about 5 to 7 feet across are exposed at the surface. These outcrops are scattered throughout. They dislodged from the upper limestone formation and rest on the shale. Also included are residential and industrial areas surrounding the city of Dubuque. In these areas, the soil has been excavated, leveled, filled, built up, or smoothed to fit construction needs. The included areas make up less than 5 percent of the complex.

Permeability of the Rozetta and the Eleroy soils is moderate, but permeability of the underlying shale in the Eleroy soil is very slow. Surface runoff is rapid. These soils have a seasonal high water table at a depth of about 2.5 to 5 feet. These soils tend to perch water at the shale contact, which causes nearby drainageways to be wet and seepy. Typically, fragments of limestone separate the firm shale material from the overlying silt material. The available water capacity in both soils is high. The content of organic matter in the surface layer of both soils is about 1 to 2 percent. Typically, the surface layer of both soils is neutral to medium acid but varies as a result of local liming practices. The subsoil is medium acid to neutral. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. These soils generally have fair tilth. They tend to puddle if worked when they are wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of these soils are in timber, but some areas are in pasture. A few areas are used as residential sites because they offer a scenic view. The soils are suited to occasional corn in rotation with small grains and to grasses and legumes for hay and pasture. If used for cultivated crops, the soils are subject to erosion. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. In most areas, slopes are too steep and too short to permit terracing; however, in some areas the less sloping soils can be terraced. A perched water table and underground springs at or near the limestone escarpment upslope cause some drainageways to be seasonally wet for long periods. Proper tile placement is necessary to drain these seepy areas and to facilitate timely field operations. A tile system and terraces are a good combination on these soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

The use of these soils for pasture or hay is effective in controlling erosion. Because there is a perched water table, some legumes may be subject to winterkill. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are well suited to trees, and some areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. Because these soils are steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Survival of seedlings or competition from undesirable plants should not be a problem. Excessive surface disturbance should be avoided during planting and harvesting to lessen the possibility of erosion.

The soils are in capability subclass IVe.

563E2—Rozetta-Eleroy silt loams, 14 to 18 percent slopes, moderately eroded. This complex consists of strongly sloping, moderately well drained soils on convex side slopes on uplands. The Rozetta soil is on the upper part of side slopes and narrow ridges, and the Eleroy soil is on the lower part of side slopes adjacent to nearby drainageways. The Rozetta and Eleroy soils are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 65 percent Rozetta soil and 30 percent Eleroy soil. Individual areas of this complex are irregular in shape and range from 15 to 45 acres in size.

Typically, the surface layer of the Rozetta soil is dark grayish brown, friable silt loam about 5 inches thick. It has pockets of yellowish brown, friable silty clay loam, which is subsoil material that has been mixed into the surface layer by plowing. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable silty clay loam with grayish brown mottles, and the lower part is mottled brown and light brownish gray, friable silty clay loam. The substratum to a depth of about 60 inches is mottled light brownish gray and yellowish brown silt loam. Typically, shale is at a depth of about 6 or 7 feet.

Typically, the surface layer of the Eleroy soil is grayish brown and dark grayish brown, friable silt loam about 5 inches thick. It has pockets of dark yellowish brown, friable silt loam, which is subsoil material that has been mixed into the surface layer by plowing. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable silty clay loam; the middle part is yellowish brown, friable silty clay loam with pale brown mottles; and the lower part is mottled pale brown and yellowish brown, friable silty clay loam. The substratum to a depth of about 39 inches is brown silty clay loam with chert fragments. The substratum is underlain by greenish gray and pale olive, calcareous clayey shale.

Included with these soils in mapping are a few small areas of shale outcrops. These outcrops are on the lower part of side slopes. The areas are wet and seepy and are low in fertility. In these areas, seeding is difficult to establish without properly installed interceptor tile drainage and without additional fertilizer applications. Also included are areas where a few limestone boulders about 5 to 7 feet across are exposed at the surface. These outcrops are scattered throughout. They dislodged from the upper limestone formation and rest on the shale. In some areas on the upper part of side slopes, the surface layer is yellowish brown silty clay loam. In these areas, the content of organic matter is low, tilth is poor, and larger amounts of fertilizer are required. Also included are residential and industrial areas surrounding the city of Dubuque. In many of these areas, the soil has been excavated, leveled, filled, built up, or smoothed to fit construction needs. The included areas make up less than 5 percent of the complex.

Permeability of the Rozetta and the Eleroy soils is moderate, but permeability of the underlying shale in the Eleroy soil is very slow. Surface runoff is rapid. These soils have a seasonal high water table at a depth of about 2.5 to 5 feet. These soils also tend to perch water at the shale contact, which causes nearby drainageways to be wat and seepy. Typically, fragments of limestone separate the firm shale material from the overlying silty material. The available water capacity in both soils is high. The content of organic matter in the surface layer of both soils is about 0.5 to 1 percent. Typically, the surface layer of both soils is neutral to medium acid but varies as a result of local liming practices. The subsoil is medium acid to neutral. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. These soils generally have fair tilth. They tend to puddle if worked when they are wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of these soils are in cultivated crops in rotation with hay or pasture. A few areas are used as residential sites because they offer a scenic view. The soils are suited to occasional corn in rotation with small grains and to grasses and legumes for hay and pasture. The soils are subject to erosion if they are used for cultivated crops. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce further soil loss. In most areas, the slopes are too steep and too short to permit terracing; however, in some areas the less sloping soils can be terraced. A perched water table and underground springs at or near limestone escarpments upslope cause some drainageways to be seasonally wet for long periods. Proper tile placement is necessary to drain these seepy areas and to facilitate timely field operations. A tile system and terraces are a good combination on these soils. Larger amounts of fertilizer are needed on these soils than on the uneroded Rozetta and Eleroy soils. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

The use of these soils for pasture or hay is effective in controlling erosion. Because there is a perched water table, some legumes may be subject to winterkill. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. Because these soils are steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Survival of seedlings or competition from undesirable plants should not be a problem. Excessive surface disturbance should be avoided during planting and harvesting to reduce further erosion.

The soils in this complex are in capability subclass IVe.

589+—Otter silt loam, overwash, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on bottom lands and in the lower part of broad drainageways on uplands. This soil ponds water and is subject to frequent flooding. Individual areas are elongated on bottom lands and irregular in shape along upland drainageways. The areas range from 5 to 30 acres in size.

Typically, the surface layer is stratified, dark grayish brown and grayish brown, friable silt loam about 8 inches thick. The next layer is a black and very dark gray, friable silt loam buried surface layer about 26 inches thick. It was buried by recent, lighter colored sediment. The substratum to a depth of about 60 inches is dark gray silt loam. In some places, the surface soil has no stratified sediment and is about 20 inches thick.

Included with this soil in mapping are areas adjacent to foot slopes where the soil is underlain by shale at a depth of 3 to 4 feet. These areas are generally seasonally wet throughout the growing season. They make up 5 to 10 percent of the map unit.

Permeability of this Otter soil is moderate, and runoff is very slow. This soil has a seasonal high water table near or above the surface. The available water capacity is high to very high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface soil is slightly acid to neutral. The substratum generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet.

In many areas this soil is cultivated. Some areas are in permanent pasture. This soil is well suited to corn, soybeans, and oats and to grasses and legumes for hay and pasture if it is artificially drained and protected from flooding. It is susceptible to runoff from the more sloping soils upslope. Diversion terraces placed on the soils upslope help protect this soil from siltation.

This soil is wet as a result of a high water table, slow runoff, and flooding. Tile functions well in this soil if proper outlets are available.

Areas that flood frequently are used mainly for pasture. Overgrazing or grazing during wet periods causes excessive puddling. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass IIw.

663D2—Seaton silt loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, well drained soil on convex ridges and side slopes on uplands. Individual areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. There are pockets of dark yellowish brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is dark yellowish brown and yellowish brown, friable silt loam about 49 inches thick. The substratum to a depth of about 60 inches is light yellowish brown silt loam. In some wooded areas, the surface soil is more than 7 inches thick.

Included with this soil in mapping are areas, on the upper part of side slopes, where the surface layer is yellowish brown, friable silt loam. In these areas, the content of organic matter is low and larger amounts of fertilizer are required. These included areas make up less than 5 percent of this map unit.

Permeability of this Seaton soil is moderate, and surface runoff is medium. There is more runoff and less infiltration of water on this soil than on the uneroded soils. The available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is slightly acid, and lime is needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid to strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are in pasture. Some areas are cultivated. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to further erosion. Terracing, contour stripcropping, and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. Terraces can be constructed on this soil; however, they are difficult to stabilize because there is insufficient clay for adequate compaction. More fertilizer is needed on this soil than on the uneroded Seaton soils. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

663F—Seaton silt loam, 18 to 25 percent slopes. This is a steep, well drained soil on short, convex side slopes on the uplands. Individual areas are elongated or irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown and very dark gray, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 6 inches thick. The subsoil to a depth of about 60 inches is dark yellowish brown and yellowish brown, friable silt loam. In places the surface layer is about 6 inches thick, and there is no subsurface layer.

Permeability of this Seaton soil is moderate, and surface runoff is rapid. The available water capacity is very high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is neutral or slightly acid, and lime is needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are used as woodland or pasture. This soil is poorly suited to cultivated crops. It is better suited to grasses and legumes for hay and pasture. The operation of farm machinery is difficult on this soil because of the steep slopes and the gullies and drainageways. If this soil is used for cultivated crops, it is subject to severe erosion.

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

This soil is suited to trees, and most areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Natural and planted seedlings survive and grow well if there is no competing vegetation and they are spaced closely together to achieve the desired stand density. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

712E—Schapville silt loam, 9 to 18 percent slopes. This is a strongly sloping and moderately steep, moderately well drained soil on convex side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is black, friable silt loam about 7 inches thick. The subsurface layer is black and very dark gray, friable silty clay loam about 7 inches thick. The subsoil is about 9 inches thick. The upper part is very dark gray, friable silty clay loam with olive brown mottles, and the lower part is light olive brown, firm silty clay loam with grayish brown and yellowish brown mottles. Mottled light yellowish brown and light gray, clayey calcareous shale is at a depth of about 23 inches.

Permeability of this Schapville soil is moderate in the surface layer and subsoil and very slow in the clayey calcareous shale. Surface runoff is rapid. The available water capacity is moderate. This soil tends to perch water at a depth of 2.5 to 5 feet; springs develop during wet seasons. The content of organic matter in the surface layer is about 3 to 4 percent. Typically, the surface layer is neutral, but the subsoil is neutral or mildly alkaline. The subsoil generally has a low supply of available phosphorus and potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are in pasture or hay. This soil generally is not suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Because areas of this soil are generally small, this soil is often cultivated with adjacent soils that are better suited to crops. If this soil is used for cultivated crops, there is a severe hazard of erosion. In addition, this soil is seasonally wet and seepy. Tile drainage is generally needed but is difficult to install. The water table has to be intercepted upslope before it reaches the root zone. If this soil is terraced with adjacent soils, terracing should be used in combination with tile. Productivity is low, however, even with good management.

The use of this soil for pasture is effective in controlling erosion, although the grazing capacity of this soil is low and grazing must be limited. Overgrazing or grazing when the soil is very wet causes surface compaction, increases runoff, and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is in capability subclass VIe.

712F—Schapville silt loam, 18 to 30 percent slopes. This is a steep and very steep, moderately well drained soil on short, convex side slopes along drainageways on uplands. Individual areas are narrow and elongated or irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer of the Schapville soil is very dark gray, friable silt loam about 7 inches thick. The subsoil is about 4 inches thick. It is light olive brown, firm silty clay loam with grayish brown and yellowish brown mottles. Mottled light yellowish brown and light gray, very firm, clayey calcareous shale is at a depth of about 11 inches. In places, shale is exposed at the surface. In some places, the surface layer is silty clay loam.

Included with this soil in mapping are small areas where limestone remnants outcrop. These outcrops are about 5 to 10 feet across and generally protrude 2 or 3 feet above the surface. They can alter some management practices. These included areas make up 10 to 15 percent of this map unit.

Permeability of this Schapville soil is moderate in the surface layer and subsoil and very slow in the clayey calcareous shale. Surface runoff is rapid. The Schapville soil generally has a seasonal high water table at a depth of 2.5 to 5 feet, but water tends to perch below the surface layer early in spring. The available water capacity is very low. The content of organic matter in the surface layer is about 3 to 4 percent. In eroded areas, the surface layer is less than 0.5 percent organic matter. Typically, the surface layer is neutral, and the subsoil is neutral or mildly alkaline. Liming is generally not needed to establish seedings. The subsoil generally has a low supply of available phosphorus and potassium. This soil generally has good tilth except in eroded areas.

Most areas of this soil are in permanent pasture or trees. This soil is not suited to corn, soybeans, oats, or hay. If the soil is cultivated, erosion is a severe hazard. The operation of farm machinery is difficult because of the steep slopes and the many small drainageways and gullies. During wet seasons, the areas are slippery because of wetness and shallowness to shale. In many areas, large fragments of limestone hinder tillage operations. The soil along drainageways is wetter than the soil in surrounding areas because of seepage caused by the shale. In some areas where the soil is seepy and wet from springs upslope, side slopes are slippery and the operation of equipment is hazardous.

This soil is poorly suited to pasture because of the difficulty in applying lime and fertilizer on the steep slopes. The carrying capacity on this soil is low, and grazing should be limited. Overgrazing or grazing when this soil is too wet causes surface compaction and increased runoff.

This soil is in capability subclass VIIe.

714C—Winneshiek loam, 20 to 30 inches to limestone, 3 to 9 percent slopes. This is a moderately sloping, well drained soil on convex ridges and side slopes on uplands. Individual areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown and very dark gray, friable loam about 8 inches thick. The subsurface layer is dark grayish brown, friable loam about 5 inches thick. The subsoil is about 14 inches thick. The upper part is brown and dark yellowish brown, friable loam, and the lower part is reddish brown, very firm silty clay. The subsoil is underlain by hard, fractured limestone at a depth of about 27 inches.

Included with this soil in mapping are small scattered areas of limestone outcrops on the lower part of side slopes. These areas are droughty, and the outcrops hinder tillage operations. The included areas make up less than 5 percent of this map unit.

Permeability of this Winneshiek soil is moderate, and surface runoff is medium. The available water capacity is low. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is slightly acid or medium acid. The upper part of the subsoil is slightly acid to medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth. It warms quickly in spring and generally can be worked soon after a rain.

Most areas of this soil are in pasture. Some areas are cultivated. This soil is poorly suited to corn, soybeans, and small grains. It is susceptible to erosion, and it is droughty in years of average or below average rainfall. Yields are generally low, even in years of average rainfall. Because slopes are generally short and irregular, some conservation practices are difficult to use. Conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil loss. This soil is not well suited to terracing because of shallowness to limestone. Returning crop residue to the soil or regularly adding other organic material helps to conserve moisture and increases water infiltration.

The use of this soil for pasture or hay is effective in controlling erosion. Pastures can easily be overstocked, however, because the available water capacity is low. Overgrazing causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees, and a few small areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIIe.

726—Hayfield loam, 32 to 40 inches to sand and gravel, 0 to 3 percent slopes. This is a very gently sloping, somewhat poorly drained soil on terraces along streams. Individual areas are broad and irregular in shape and range from 20 to 100 acres in size.

Typically, the surface layer is very dark gray and black, friable loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is brown, friable loam and clay loam, and the lower part is brown and pale brown, friable sandy loam with brown and strong brown mottles. The substratum to a depth of about 60 inches is dark yellowish brown coarse sand with brownish yellow mottles. In some places, stratified coarse sand and gravel is within 24 inches of the surface.

Included with this soil in mapping are a few areas of poorly drained soils in lower lying swales. These soils stay wet longer, which can delay field operations in spring. These included soils make up about 5 to 10 percent of this map unit.

Permeability of this Hayfield soil is moderate in the loamy material and rapid in the underlying sand and gravel. Surface runoff is slow, and the soil tends to be ponded during spring. This soil has a seasonal high water table at a depth of 2.5 to 5 feet. The available water capacity is moderate. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is slightly acid to medium acid but varies as a result of local liming practices. The subsoil is medium acid to strongly acid. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. The surface layer has good tilth, but it tends to puddle if worked when it is wet. This soil generally crusts after hard rains if the platy subsurface layers are mixed into the plow layer during cultivation.

Most areas of this soil are in cultivated crops. This soil is suited to corn, soybeans, and small grains and to grasses for hay and pasture. This soil has a seasonal high water table in the spring. The water table, however, drops rapidly during the growing season. During wet seasons, this soil benefits from subsurface drains. Placement of drains is difficult in some areas because of loose, water-bearing sand and gravel below a depth of 3 feet. Returning crop residue to the soil or regularly adding other organic material increases fertility and water infiltration.

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

This soil is suited to trees, and a few small scattered areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIs.

763E2—Exette silt loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, well drained soil on short, convex side slopes on uplands. Individual areas are narrow, elongated, or irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. There are pockets of yellowish brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 26 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is yellowish brown, friable silt loam with grayish brown mottles; and the lower part is light brownish gray, friable silt loam. The substratum to a depth of about 60 inches is light brownish gray and light olive brown silt loam. In places the surface layer is yellowish brown, friable silt loam.

Included with this soil in mapping are a few small areas of Lindley soils on the lower part of side slopes. Lindley soils, which formed in glacial till, are seepy during wet seasons and are low in fertility. The included soils make up less than 5 percent of this map unit.

Permeability of this Exette soil is moderate, and surface runoff is rapid. The available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is neutral. The upper part of the subsoil is neutral to slightly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas of this soil are cultivated, although some areas are being returned to pasture or trees. This soil is poorly suited to cultivated crops. If this soil is used for cultivated crops, there is a hazard of erosion. Conservation tillage, which leaves crop residue on the surface throughout the year, and grassed waterways help prevent excessive soil loss. In most areas this soil is not suited to terracing because the slopes are too steep, short, and complex. Returning crop reside to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass IVe.

763F2—Exette silt loam, 18 to 25 percent slopes, moderately eroded. This is a steep, well drained soil on short, convex side slopes on uplands. Individual areas are narrow, elongated, or irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. There are pockets of yellowish brown, friable silt loam where the subsoil has been mixed into the surface layer by plowing. The subsoil is about 23 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is yellowish brown, friable silt loam; and the lower part is light brownish gray, friable silt loam. The substratum to a depth of about 60 inches is light brownish gray and light olive brown silt loam. In places the surface layer is yellowish brown, friable silt loam.

Included with this soil in mapping are a few small areas of Lindley soils on the lower part of side slopes. Lindley soils formed in glacial till. They are seepy during wet seasons and are low in fertility. The included soils make up about 5 to 10 percent of this map unit.

Permeability of this Exette soil is moderate, and surface runoff is rapid. The available water capacity is very high. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface layer is neutral. The upper part of the subsoil is neutral to slightly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Many areas of this soil are cultivated, although some areas are being returned to pasture. This soil is not suited to cultivated crops and is only moderately well suited to hay. The operation of farm machinery is difficult on this soil because of the steep slopes and the numerous small drainageways. If this soil is used for cultivated crops, there is a serious hazard of further erosion. Crops that require tillage should be grown only to reestablish grasses and legumes for hay and pasture.

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

This soil is suited to trees. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. Because this soil is steep, the operation of equipment is hazardous. Special equipment can be used, but with caution. Survival of seedlings or competition from undesirable plants should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

This soil is in capability subclass VIe.

777B—Wapsie loam, 2 to 7 percent slopes. This is a gently sloping and moderately sloping, well drained soil on terraces along streams and rivers. It is on convex slopes. Individual areas are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. The subsurface layer is brown and very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part is brown, friable loam; the middle part is dark yellowish brown, friable sandy loam with 5 percent gravel; and the lower part is strong brown, very friable sand with 10 percent gravel. The substratum to a depth of about 60 inches is brownish yellow, yellowish brown, and strong brown sand and coarse sand with 10 percent fine gravel.

Included with this soil in mapping are a few areas of Lamont soils in somewhat higher positions on the landscape. Lamont soils have a higher content of sand than the Wapsie soil and are more droughty. The included soils make up less than 5 percent of this map unit.

Permeability of this Wapsie soil is moderate in the loamy material and very rapid in the underlying coarse sand and gravel. Surface runoff is medium. The available water capacity is low to moderate. The content of organic matter is about 1.5 to 2.5 percent. Typically, reaction is medium acid in the surface layer but varies as a result of previous liming practices. Generally, lime is needed if it has not been applied in the past 3 to 5 years. The subsoil is medium acid to strongly acid. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops, hay, and pasture. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to wind and water erosion. This soil is droughty, but production of crops is good if rainfall is normal and timely. Conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil erosion and conserve moisture. Returning crop residue to the soil or regularly adding other organic material increases fertility and the infiltration of water.

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

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or harvesting trees.

This soil is in capability subclass IIe.

814B—Rockton loam, 2 to 5 percent slopes. This is a gently sloping, well drained soil on convex ridges on uplands. Individual areas are broad and irregular in shape and range from 10 to 20 acres in size.

Typically, the surface layer is very dark gray, friable loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown, friable loam about 12 inches thick. The subsoil is about 10 inches thick. The upper part is dark yellowish brown, friable loam, and the lower part is brown and yellowish brown, firm clay loam. The subsoil is underlain at a depth of about 29 inches by hard, fractured limestone. In places, the depth to limestone is as much as 50 inches.

Included with this soil in mapping are areas of small limestone outcrops. These areas tend to be more droughty than the areas of Rockton loam, and the outcrops hinder tillage. The included areas, which are scattered throughout the map unit, make up less than 5 percent of the map unit.

Permeability of this Rockton soil is moderate, and surface runoff is medium. The available water capacity is low to moderate. The content of organic matter in the surface layer is about 3 to 4 percent. Typically, reaction in the surface layer is slightly acid but varies as a result of previous liming practices. Generally, lime is needed if it has not been applied in the past 3 to 5 years. The subsoil is slightly acid or medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops, hay, and pasture. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to wind and water erosion. This soil is very droughty unless rainfall is above normal and timely. Conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil erosion and conserve moisture. This soil is poorly suited to terracing because of shallowness to bedrock. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is in capability subclass IIe.

814C—Rockton loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on convex ridges and side slopes on uplands. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is very dark gray, friable loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark brown, friable loam about 8 inches thick. The subsoil is about 10 inches thick. The upper part is dark yellowish brown, firm clay loam. The subsoil is underlain at a depth of about 25 inches by hard, fractured limestone.

Included with this soil in mapping are areas of small limestone outcrops. These areas tend to be more droughty than the areas of Rockton loam, and the outcrops hinder tillage. The included areas, which are scattered throughout the map unit, make up about 5 to 10 percent of the map unit.

Permeability of this Rockton soil is moderate, and surface runoff is medium. The available water capacity is low to moderate. The content of organic matter in the surface layer is about 2.5 to 3.5 percent. Typically, reaction in the surface layer is slightly acid but varies as a result of previous liming practices. Generally, lime is needed if it has not been applied in the past 3 to 5 years. The subsoil is slightly acid or medium acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are in cultivated crops, hay, and pasture. This soil is poorly suited to corn, soybeans, and small grains. It is better suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, it is subject to wind and water erosion. This soil is very droughty unless rainfall is above normal and timely. Conservation tillage, which leaves crop residue on the surface throughout the year, can reduce soil erosion and conserve moisture. This soil is poorly suited to terracing because of the shallow depth to bedrock. Returning crop residue to the soil or regularly adding other organic material increases fertility and maintains good tilth.

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

This soil is in capability subclass IIIe.

915C—Rollingstone silt loam, 5 to 9 percent slopes. This is a moderately sloping, well drained soil on convex ridges and side slopes on uplands. Individual areas are irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil extends to a depth of about 60 inches. In the upper part, it is brown, friable silty clay loam and has about 15 percent chert fragments; in the middle part, it is red, firm and very firm cherty clay and has about 30 percent chert fragments; and in the lower part, it is dark reddish brown and red, firm very cherty clay and has about 50 percent chert fragments. In the western one-third of the county, this soil has a surface layer of loam or sandy loam and has less clay and a higher concentration of chert fragments in the subsoil and substratum.

Included with this soil in mapping are small areas where chert fragments are concentrated on the surface. These areas are scattered throughout the map unit. They tend to be droughty. The chert fragments hinder haying and tillage operations. The included areas make up less than 5 percent of this map unit.

Permeability of this Rollingstone soil is slow, and surface runoff is medium. The available water capacity is moderate. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, reaction in the surface layer is slightly acid but varies as a result of local liming practices. The subsoil is medium acid to strongly acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are in pasture or trees, but some areas are cultivated. A few areas of this soil are used as residential sites because they offer a scenic view. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in the later part of the growing season if rainfall is not timely, and it is subject to erosion in cultivated areas. Yields are low even during years of normal rainfall. Tillage is difficult because of the shallowness to the cherty limestone. Cultivated crops should be grown only to reestablish seedings. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce excessive soil loss. If terraces are used on this soil, the cherty limestone fragments and the clayey subsoil may interfere in construction. The regular addition of organic material increases fertility and water infiltration.

Although the carrying capacity of the soil is very low, the use of this soil for pasture is effective in controlling erosion. Overgrazing, however, causes surface compaction and increases runoff. Proper stocking, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas remain in native hardwoods. There should be no problems in planting new stands of trees if species are selected and managed properly. The use of silvicultural practices that do not leave individual trees widely spaced reduces the windthrow hazard.

This soil is in capability subclass IIIe.

915C2—Rollingstone silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, well drained soil on convex ridges and side slopes on uplands. Individual areas are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. There are pockets of brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil extends to a depth of about 60 inches. The upper part of the subsoil is brown, friable silty clay loam and about 15 percent chert fragments. The middle part is red, firm and very firm cherty clay and about 30 percent chert fragments. The lower part is dark reddish brown and red, firm cherty clay and about 50 percent chert fragments.

Included with this soil in mapping are small areas where chert fragments are concentrated on the surface. These areas, which are scattered throughout the map unit, tend to be droughty. The chert fragments hinder haying and tillage operations. Also included are areas on the upper part of side slopes where the surface layer is red, firm cherty clay and about 30 percent chert fragments. In these areas the content of organic matter and the available water capacity are low, tilth is poor, and larger amounts of fertilizer are required. The included areas make up about 5 to 10 percent of this map unit.

Permeability of this Rollingstone soil is slow, and surface runoff is medium. The available water capacity is moderate. There is more runoff and less infiltration of water on this soil than on the uneroded Rollingstone soils. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, reaction in the surface layer is slightly acid but varies as a result of local liming practices. The subsoil is medium acid to strongly acid. The subsoil generally has a very low supply of available phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are in pasture or trees, but a few areas are cultivated. A few areas of this soil are used as residential sites because they offer a scenic view. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty in the later part of the growing season if rainfall is not timely, and it is subject to erosion where cultivated. Yields are low even during years of normal rainfall. Tillage is difficult because of the shallowness to the cherty limestone. Cultivated crops should be grown only to reestablish seedings. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce excessive soil loss. If terraces are used on this soil, the cherty limestone fragments and the clayey subsoil may interfere in construction. More fertilizer is needed on this soil than on the uneroded Rollingstone soils. Regularly adding organic material increases fertility and water infiltration.

Although the carrying capacity of this soil is very low, the use of this soil for pasture is effective in controlling erosion. Overgrazing, however, causes surface compaction and increases runoff. Proper stocking, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to trees. There should be no problems in planting new stands of trees if species are selected and managed properly. The use of silvicultural practices that do not leave individual trees widely spaced can reduce the windthrow hazard.

This soil is in capability subclass IIIe.

915D2—Rollingstone silt loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, well drained soil on convex side slopes on uplands. Individual areas are elongated and range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 5 inches thick. There are pockets of brown, friable silty clay loam where the subsoil has been mixed into the surface layer by plowing. The subsoil extends to a depth of about 60 inches. The upper part of the subsoil is brown, friable silty clay loam and about 15 percent chert fragments. The middle part is red, firm and very firm cherty clay and about 30 percent chert fragments. The lower part is dark reddish brown and red, firm very cherty clay and about 50 percent chert fragments.

Included with this soil in mapping are small areas where chert fragments are concentrated on the surface. These areas, which are scattered throughout the map unit, tend to be droughty. The chert fragments hinder haying and tillage operations. Also included are areas on the upper part of side slopes where the surface layer is red, firm cherty clay and about 30 percent chert fragments. In these areas the content of organic matter and the available water capacity are low, tilth is poor, and larger amounts of fertilizer are required. The included areas make up about 5 to 10 percent of this map unit.

Permeability of this Rollingstone soil is slow, and surface runoff is rapid. The available water capacity is moderate. There is more runoff and less infiltration of water on this soil than on the uneroded Rollingstone soils. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, reaction in the surface layer is slightly acid but varies as a result of local liming practices. The subsoil is medium acid to strongly acid. The subsoil generally has a very low supply of avialable phosphorus and potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

Most areas of this soil are in hay and pasture, but a few areas are in trees. A few areas are used as residential sites because they offer a scenic view. This soil is poorly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. It is droughty during the later part of the growing season if rainfall is not timely, and it is subject to erosion where cultivated. Tillage is difficult because of the shallowness to the cherty limestone. Cultivated crops should be grown only to reestablish seedings. Contour stripcropping and conservation tillage, which leaves crop residue on the surface throughout the year, can reduce excessive soil loss. If terraces are constructed on this soil, cherty limestone and the clayey subsoil may interfere during construction. More fertilizer is needed on this soil than on the uneroded Rollngstone soils. The regular addition of organic material increases fertility and water infiltration.

Although the carrying capacity of this soil is very low, the use of this soil for pasture is effective in controlling erosion. Overgrazing, however, causes surface compaction and increases runoff. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is suited to trees. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations to planting or harvesting trees. The use of silvicultural practices that do not leave individual trees widely spaced can reduce the windthrow hazard.

This soil is in capability subclass IVe.

930B—Orion silt loam, 1 to 4 percent slopes. This is a gently sloping, somewhat poorly drained soil on upland drainageways and along intermittent streams below more sloping, loess-covered upland soils. This soil is frequently flooded. Drainageways are about 100 to 200 feet wide. Individual areas are long and irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The next layer is a stratified substratum about 23 inches thick. It is dark grayish brown, grayish brown, and brown silt loam with brown, strong brown, and dark gray mottles in the lower part. The underlying material to a depth of about 60 inches is a black mucky silt loam and silty clay loam buried surface layer. It is the former surface layer, which has been buried by recent sediment.

Included with this soil in mapping are small areas of a poorly drained soil in the lower positions. These areas are along the lower part of drainageways. They make up about 5 to 10 percent of this map unit.

Permeability of this Orion soil is moderate, and surface runoff is medium to slow. This soil has a seasonal high water table at a depth of 1 foot to 3 feet. The available water capacity is very high. The content of organic matter in the surface layer is about 1 to 3 percent. Typically, reaction is neutral or slightly acid throughout the profile. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It has a tendency to puddle if worked when it is wet and to crust after hard rains.

Some areas of this soil are cultivated, although many areas are in permanent pasture. This soil is moderately well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture if it is artificially drained and protected from flooding. The soil is wet as a result of flooding, slow runoff, and a seasonal high water table. Tile functions well in this soil if proper outlets are available. This soil is susceptible to high-velocity, concentrated runoff from the adjoining, more sloping upland soils. It can be protected from excess water by diversion terraces constructed on the adjoining upland slopes.

This soil is suited to pasture. Many areas that are small and inaccessible along narrow drainageways and that are subject to frequent overflow are in permanent pasture. Overgrazing or grazing when the soil is too wet, however, causes excessive puddling. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Because this soil is somewhat poorly drained, the use of equipment needs to be restricted to drier times of the year or to winter when the ground is frozen. Special high flotation equipment can be used for harvesting or management if it is necessary during wet periods. There should be no problems in planting new stands of trees if species are selected and managed properly.

This soil is in capability subclass IIIw.

951F—Medary silt loam, 18 to 30 percent slopes. This is a steep to very steep, well drained soil along drainageways and on short escarpments of high stream terraces along tributaries of the Mississippi River. Individual areas are narrow and irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 3 inches thick. The subsoil is about 23 inches thick. The upper part is dark grayish brown and brown, friable silty clay; the middle part is reddish brown, firm silty clay; and the lower part is reddish brown, firm silty clay. The substratum to a depth of about 60 inches is stratified, grayish brown silt loam and reddish brown silty clay loam with light olive brown mottles. It is mildly alkaline and strongly effervescent in the lower part. In some places, the surface layer is dark grayish brown and brown silty clay loam.

Included with this soil in mapping are a few small areas of limestone boulders. These areas are on the lower part of side slopes. The boulders are 3 to 5 feet in diameter. They dislodged from bedrock at higher elevations. These included areas make up less than 5 percent of the map unit.

Permeability of this Medary soil is slow, and surface runoff is rapid. The available water capacity is moderate. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, the surface and subsurface layers are slightly acid to medium acid. The subsoil is mildly alkaline to strongly acid. The subsoil generally has a very low supply of available phosphorus and a medium supply of available potassium. This soil has fair tilth. It crusts after hard rains. The surface layer puddles easily when it is wet and becomes sticky and difficult to work.

Most areas of this soil are in permanent pasture. This soil generally is not suited to corn, soybeans, or small grains, or to grasses and legumes for hay. In many areas the soil is too steep for the operation of ordinary farm machinery. This soil is subject to severe erosion if cultivated.

This soil is poorly suited to pasture. The slope makes it difficult to apply fertilizer and lime; consequently, productivity is generally very low. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and puddling of the soil. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are needed for maximum productivity.

This soil is suited to trees, and some areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour can reduce soil erosion. The slope makes the operation of equipment hazardous. Special equipment can be used, but with caution. Seedlings do not survive well. They can be planted close together to achieve the desired stand density. The use of silvicultural practices that do not leave individual trees widely spaced can reduce the windthrow hazard.

This soil is in capability subclass VIIe.

964F—Fayette-Rock outcrop complex, 14 to 25 percent slopes. This complex consists of the moderately steep and steep, well drained Fayette soil on short, convex side slopes on uplands and areas of Rock outcrop, which are scattered throughout. The Fayette soil and the Rock outcrop are in areas that are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 75 percent Fayette soil and 25 percent Rock outcrop. Individual areas are narrow and elongated or irregular in shape and range from 10 to 20 acres in size.

Typically, the surface layer of the Fayette soil is dark brown, friable silt loam about 5 inches thick. The subsurface layer is brown and dark grayish brown friable silt loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part is dark yellowish brown, friable silty clay loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam with grayish brown mottles. The substratum to a depth of about 60 inches is light olive brown silt loam with grayish brown mottles. In places shale bedrock is at a depth of about 50 inches.

Rock outcrop consists of limestone boulders that dislodged from the Silurian limestone escarpment upslope. The boulders protrude at the surface about 3 to 5 feet and rest on shale bedrock, which is at a depth of 8 to 10 feet. The outcrops are approximately 10 to 20 feet in diameter and 60 to 120 feet apart.

Permeability of the Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid, and lime is needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid to strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. The Fayette soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas are in trees, but some areas are in permanent pasture. The Fayette soil is not suited to cultivated crops and is poorly suited to pasture. It is best to leave the areas in trees. The areas between boulders provide some pasture and forage, but the limestone boulders are a limitation. The operation of farm machinery is difficult and impractical because of the steepness of the slope and the many boulders. Springs can develop and make the lower part of slopes wet and seepy.

This soil is suited to trees, and most areas remain in native hardwoods. To reduce the hazard of erosion, careful consideration should be given to the location of trails or roads used in logging. Placing trails or roads on the contour or nearly on the contour can reduce soil erosion. Boulders and the slope make the operation of equipment hazardous. Special equipment can be used, but with caution. Survival of seedlings should not be a problem. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling.

The soils in this complex are in capability subclass VIIe.

978B—Festina silt loam, 1 to 5 percent slopes. This is a gently sloping, well drained soil on stream terraces along major streams and rivers. This soil rarely floods. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is about 6 inches thick. It is very dark gray, friable silt loam and has some grayish brown streaks and pockets. The subsurface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is brown and dark yellowish brown, friable silt loam; the middle part is dark yellowish brown, friable silty clay loam; and the lower part is dark yellowish brown and yellowish brown, friable silt loam with grayish brown mottles. The substratum to a depth of about 60 inches is stratified, grayish brown and light brownish gray silt loam and yellowish brown and strong brown fine sandy loam.

Permeability of this Festina soil is moderate, and surface runoff is slow to medium. The available water capacity is very high. The content of organic matter in the surface layer is about 2 to 3 percent. Typically, the surface layer is neutral or slightly acid. The upper part of the subsoil is medium acid or strongly acid. The subsoil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. Very few areas remain in trees. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Erosion is only a slight hazard. Conservation tillage, which leaves crop residue on the surface throughout the year, helps to prevent soil loss. This soil is below the more sloping upland soils and is subject to siltation. Diversion terraces are needed in some areas to protect the soil from local runoff. Returning crop residue to the soil or regularly adding other organic material increases fertility, reduces crusting, and increases water infiltration.

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

This soil is suited to trees, and a few areas remain in native hardwoods. Natural and planted seedlings survive and grow well if there is no competing vegetation. Competing vegetation can be controlled or removed by careful site preparation or by spraying, cutting, or girdling. There are no hazards or limitations in planting or harvesting trees.

This soil is in capability subclass IIe.

981B—Worthen silt loam, 2 to 5 percent slopes. This is a gently sloping, well drained soil on narrow foot slopes directly below more sloping soils on upland side slopes. Individual areas are smooth and elongated and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 21 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silt loam, and the lower part is yellowish brown, friable silt loam with grayish brown and yellowish brown mottles. The substratum to a depth of about 60 inches is yellowish brown silt loam.

Permeability of this Worthen soil is moderate. Surface runoff is medium. The available water capacity is very high. The content of organic matter in the surface layer is about 3 or 4 percent. Typically, the surface layer and the subsoil are neutral or slightly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has good tilth, but it tends to puddle if worked when it is wet.

Most areas of this soil are cultivated. This soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This soil receives runoff water from more sloping soils upslope and is subject to siltation in some places. Also, erosion is a slight hazard in cultivated areas. Diversion terraces are needed in some areas to protect the soil from local runoff and soil erosion. Conservation tillage, which leaves crop residue on the surface throughout the year, also helps prevent excessive soil loss.

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

This soil is in capability subclass IIe.

1490—Caneek silt loam, channeled, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on bottom lands on islands and in sloughs of the Mississippi River. This soil is subject to frequent flooding. Individual areas are elongated and range from 20 to 50 acres in size.

Typically, the surface layer consists of recently deposited sediment. It is stratified, grayish brown, dark gray, gray, and olive gray, friable silt loam about 40 inches thick and has brown and reddish brown mottles. There is a buried surface layer of black silty clay loam below the recent sediment.

Included with this soil in mapping are a few small areas of sediment-filled, shallow oxbows and old river channels. These areas pond water part of the year, depending on the fluctuation in river levels. Also included are sandy areas on the upstream part of the islands. These areas, when they are not flooded, are droughty and have a low available water capacity. The included areas make up about 10 to 20 percent of this map unit.

Permeability of this Caneek soil is moderate. Surface runoff is slow. The water table is at a depth of less than 3 feet, and the soil may pond water especially in old channels. The available water capacity is very high. The content of organic matter in the surface layer is less than 0.5 percent. Typically, reaction is mildly alkaline in the silty sediment and neutral in the buried surface layer. The soil generally is very low in available phosphorus and potassium. It has poor tilth. The soil dries out slowly after rainfall. The surface layer has a tendency to puddle if worked when it is wet and to crust after heavy rains.

Most areas of this soil are idle brushy land. This soil generally is not suited to corn, soybeans, or small grains or to grasses and legumes for hay. It is suited to pasture if protected from flooding. It is wet as a result of flooding, slow runoff, and a seasonal high water table.

Privately owned areas of this soil are used mainly for pasture. Overgrazing or grazing during wet periods causes surface compaction and excessive puddling. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition. If it is not overgrazed, this soil is suitable as habitat for wetland wildlife.

This soil is in capability subclass Vw.

4110B—Urban land-Lamont complex, 2 to 7 percent slopes. This complex consists of gently sloping to moderately sloping areas of Urban land and of well drained Lamont soil. The areas are on convex ridges and side slopes on high stream terraces within the city of Dubuque. The individual areas of Urban land and of the Lamont soil are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 50 to 85 percent Urban land and 15 to 50 percent Lamont soil. The areas are broad and irregular in shape and range from 100 to several hundred acres in size.

Typically, the Urban land part of this map unit consists of areas that are covered by streets, parking lots, buildings, and other structures that obscure or alter the soils, making identification impossible (fig. 12).

Typically, the surface layer of the Lamont soil is dark grayish brown, friable fine sandy loam about 8 inches thick. The subsurface layer is brown, friable fine sandy loam about 6 inches thick. The subsoil is yellowish brown and dark yellowish brown, friable and very friable fine sandy loam about 22 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand. It has nearly horizontal layers of strong brown loamy sand 1/2 inch to 2 inches thick.

Included in mapping this complex are small areas of Chelsea soils. Chelsea soils are excessively drained. Their content of organic matter is slightly lower than that of the Lamont soil, and their available water capacity is less. Chelsea soils are more susceptible to soil blowing. They make up less than 5 percent of the complex.

Permeability of the Lamont soil is moderately rapid, and runoff on the soil is medium. The available water capacity is moderate. The content of organic matter in the surface layer is about 0.5 to 1 percent. Typically, reaction is neutral to slightly acid in the surface layer but varies as a result of local liming practices. The subsoil is medium acid to strongly acid. The subsoil generally has a medium supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to crust after hard rains.

Most areas are used for parks, lawns, and gardens and as industrial and residential building sites. The Lamont soil is suited to grasses, flowers, vegetables, trees, and shrubs. The soil is droughty if rainfall is not timely; therefore, watering plants may be necessary during the growing season. This soil is moderately suited to use as residential sites where there is no public sewer system. Contamination of the water supply is possible, however, because of the underlying sandy material. Soil

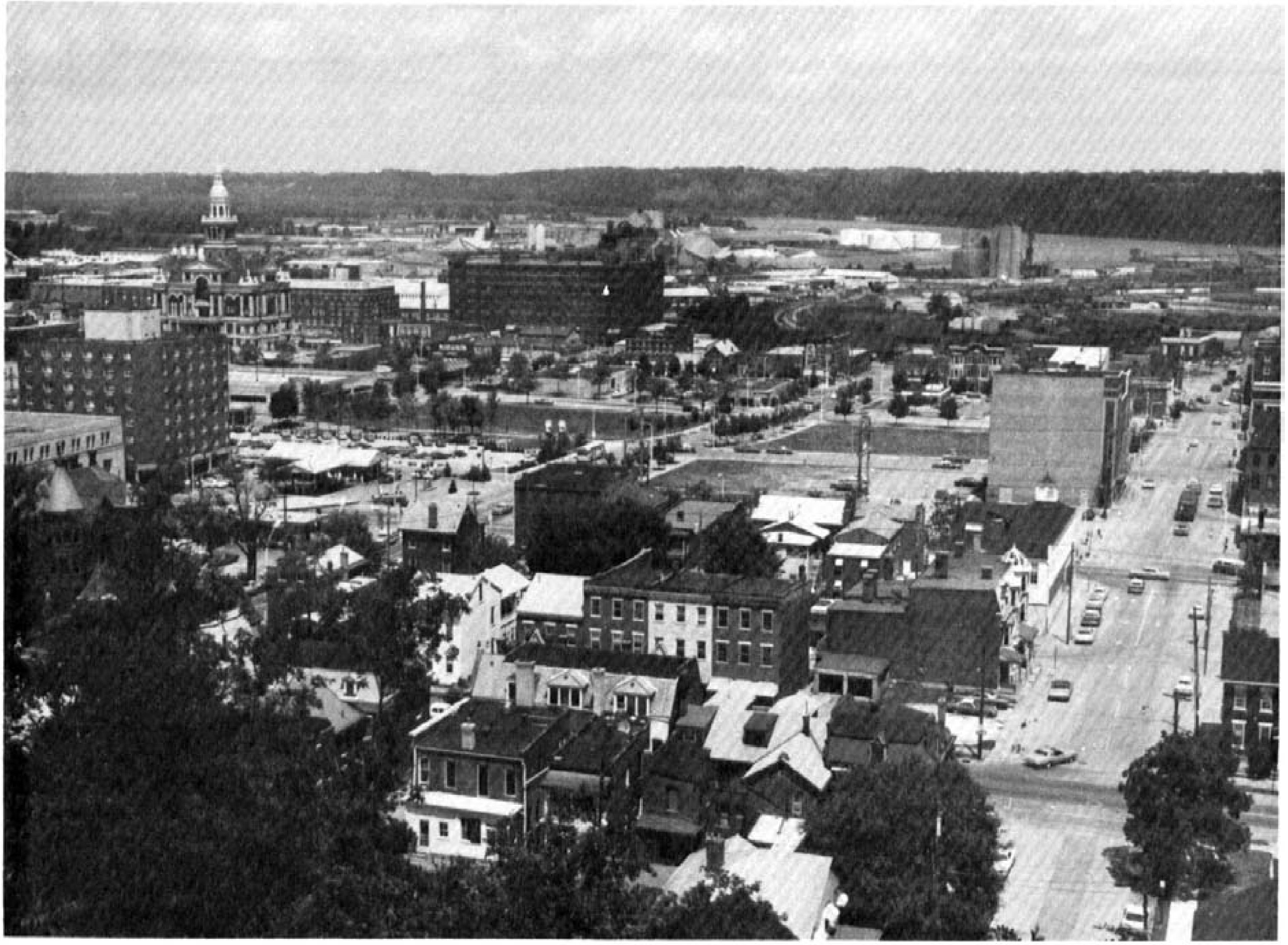

Figure 12.—A typical area of the Urban land-Lamont complex, 2 to 7 percent slopes, in downtown Dubuque.

erosion is a hazard if the soil is disturbed and left bare for a considerable period.

Maintaining a good vegetative cover, such as grass, can reduce soil and moisture losses and increase the infiltration of water. During periods of construction, temporary measures, such as silt fences, diversion terraces, and sediment control basins can control excessive runoff and keep streets and gutters relatively free of sediment.

Interpretations given for this map unit may differ from those given for the individual components. Onsite investigation is needed to determine physical and chemical properties and depth to underlying materials. Evaluation of sites is needed to determine the proper design for individual uses and to implement corrective measures.

This complex was not assigned to a capability subclass.

4158B—Urban land-Dorchester complex, 2 to 5 percent slopes. This complex consists of gently sloping areas of Urban land and of the moderately well drained Dorchester soil on wide bottom lands and along narrow drainageways within the city of Dubuque. The areas are subject to rare flooding unless they are protected or unless the surface water is diverted. The individual areas of Urban land and of the Dorchester soil are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 50 to 85 percent Urban land and 15 to 50 percent Dorchester soil. The areas are broad and elongated and range from 50 to 100 acres in size.

Typically, the Urban land part of this complex consists of areas that are covered by streets, parking lots, buildings, and other structures that obscure or alter the soils making identification impossible.

Typically, the surface layer of the Dorchester soil, where cultivated, is mixed dark grayish brown and very dark grayish brown, friable silt loam about 10 inches thick. The substratum layer is stratified dark grayish brown and brown, friable silt loam about 18 inches thick. This layer formed in recently deposited sediment. A buried silt loam surface layer extends to a depth of about 60 inches. In a few small areas, the soil has a loamy or sandy texture.

Included in mapping this complex are small areas of Worthen soils, which are well drained and are at the base of slopes near the uplands. These soils make up less than 5 percent of the complex.

Permeability of the Dorchester soil is moderate, and surface runoff is slow. The available water capacity is very high. The content of organic matter in the substratum is about 0.5 to 1 percent. Typically, reaction is moderately alkaline in the substratum and neutral in the buried surface layer. The soil generally has a low supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains.

The Dorchester soil is used for parks, lawns, and gardens and as industrial and residential building sites. It is suited to grasses, flowers, vegetables, trees, and shrubs and to use as building sites if protected from flooding. Because of flooding, this soil is poorly suited to use as residential sites where there is no public sewer system.

Flooding is the major hazard if this soil is used as building sites. The soil is subject to rapid runoff from adjacent steep slopes during periods of heavy rainfall. Measures to divert or control excess water and deposits of sediment help avoid additional problems during construction, and they protect existing residential and commercial buildings.

Interpretations for this map unit may differ from those for the individual components. Onsite investigation is needed to determine physical and chemical properties, kinds of parent material, depth to the water table, and the potential hazard of flooding. Evaluation of sites is needed to determine the proper design for individual uses and to implement corrective measures.

This complex was not assigned to a capability subclass.

4163C—Fayette-Urban land complex, 5 to 9 percent slopes. This complex consists of areas of moderately sloping, well drained Fayette soil and of Urban land on convex ridgetops and side slopes on uplands within the city of Dubuque. The individual areas of the Fayette soil and Urban land are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 50 to 75 percent Fayette soil and 25 to 50 percent Urban land. The areas are irregular in shape and extend for several miles, ranging in size from 20 to more than 100 acres.

Typically, the surface layer of the Fayette soil is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil extends to a depth of about 60 inches. It is brown, friable silty clay loam in the upper part; dark yellowish brown and yellowish brown, friable silty clay loam in the middle part; and yellowish brown, friable silt loam in the lower part. In places, the combined thickness of the surface and subsurface layers is less than 7 inches, and there are pockets of brown subsoil material because of intensive cultivation.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other structures that obscure or alter the soils making identification impossible.

Included in mapping this complex are areas where a red, clayey glacial till paleosol is at a depth of 5 to 10 feet. In these areas, the water table may be perched, thus limiting the use of the areas as sites for buildings. These areas make up less than 5 percent of the map unit.

Permeability of the Fayette soil is moderate, and surface runoff is medium. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid, and generally lime is needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Fayette soil is used mainly for parks, lawns, and gardens and as industrial and residential building sites. It is well suited to grasses, flowers, vegetables, trees, and shrubs and to use as building sites. It is suited to use as residential sites where a public sewer system is not available. Soil erosion is a hazard if this soil is disturbed and left bare for a considerable period. Maintaining a good vegetative cover, such as grass, can reduce soil losses and increase the infiltration of water. Temporary measures, such as silt fences, diversion terraces, and sediment control basins can be used during construction to reduce excessive runoff and keep streets and gutters free of sediment. Where sites have been leveled for buildings, a drainage system with proper outlets helps carry excess surface and subsurface water away from the buildings.

If the Fayette soil is used as residential sites and a public sewer system is not available, there should be no heavy traffic in the areas where septic tank absorption fields are to be placed. This soil has a tendency to compact under heavy loads during wet seasons.

Interpretations for this map unit may differ from those for the individual components. Onsite investigation is needed to determine physical and chemical properties, kinds of parent material, depth to underlying materials, and depth to the water table. Evaluation of sites is needed to determine the proper design for individual uses and to implement corrective measures.

This complex was not assigned to a capability subclass.

4163D—Fayette-Urban land complex, 9 to 14 percent slopes. This complex consists of areas of strongly sloping, well drained Fayette soil and of Urban land on side slopes on uplands within the city of Dubuque. The individual areas of the Fayette soil and Urban land are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 50 to 75 percent Fayette soil and 25 to 50 percent Urban land. The areas are irregular in shape and more than a mile long. They range from 20 to several hundred acres in size.

Typically, the surface layer of the Fayette soil is very dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown mottles. In some cultivated areas, the surface layer is less than 7 inches thick and has pockets of brown subsoil material.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other structures that obscure or alter the soils making identification impossible.

Included in mapping this complex are areas where a red, clayey glacial till paleosol and gray, clayey calcareous shale are at a depth of 5 to 10 feet. In these areas, the water table may be perched, thus limiting the use of the areas as sites for buildings. These areas make up less than 5 percent of the map unit.

Permeability of the Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid, and generally lime is needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas are used for parks, lawns, and gardens and as industrial and residential building sites. The Fayette soil is suited to grass, flowers, vegetables, trees, and shrubs and to use as building sites. It is generally suited to use as residential sites where a public sewer system is not available; however, the sewage disposal system used at such sites must be designed to accommodate the slope. Soil erosion is a hazard if the soil is disturbed and left bare for a considerable period. Maintaining a good vegetative cover, such as grass, can reduce soil losses and increase the infiltration of water. Temporary measures, such as silt fences, diversion terraces, and sediment control basins, can be used during construction to reduce excessive runoff and keep streets, gutters, and storm sewers relatively free of sediment.

Where sites have been leveled for buildings, a drainage system with proper outlets helps carry excess surface and subsurface water away from buildings. If basements are constructed, a tile system may be needed to prevent wetness and to stabilize the foundation, particularly in areas of shale or glacial till. The areas where cuts have been made may need to be stabilized to prevent slumps after heavy rainfall. These slumps are caused by water movement through the moderately permeable loess overlying the slowly permeable, red clayey glacial till or gray clayey shale.

Interpretations for this map unit may differ from those for the individual components. Onsite investigation is needed to determine physical and chemical properties, kinds of parent material, depth to underlying material, and depth to the water table. Evaluation of sites is needed to determine the proper design for individual uses and to implement corrective measures.

This complex was not assigned to a capability subclass.

4163E—Fayette-Urban land complex, 14 to 20 percent slopes. This complex consists of areas of strongly sloping, well drained Fayette soil and of Urban land on side slopes on uplands within the city of Dubuque. The individual areas of the Fayette soil and Urban land are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of about 50 to 75 percent Fayette soil and 25 to 50 percent Urban land. The areas are irregular in shape and range from 10 to 30 acres in size.

Typically, the surface layer of the Fayette soil is dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 48 inches thick. The upper part is dark yellowish brown, friable silty clay loam, and the lower part is yellowish brown, friable silty clay loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam with grayish brown mottles. In some cultivated areas, the surface layer is less than 7 inches thick and has pockets of brown subsoil material. Also in places, the soil has been altered during construction. It has been excavated, filled, leveled, built up, and smoothed to fit construction needs.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other structures that obscure or alter the soils making identification impossible.

Included in mapping this complex are small areas of Dubuque and Nordness soils on the lower part of side slopes and nose slopes. These soils have limestone at a depth of 15 to 30 inches and are droughty late in the growing season if rainfall is not timely. Also included are areas where a red clayey glacial till paleosol and gray clayey calcareous shale are at a depth of 5 to 10 feet. In these areas, the water table may be perched, thus limiting the use of the areas as sites for buildings. The included areas make up about 5 to 10 percent of this map unit.

Permeability of the Fayette soil is moderate, and surface runoff is rapid. The available water capacity is high. The content of organic matter in the surface layer is about 1 to 2 percent. Typically, the surface layer is slightly acid, and generally lime is needed if it has not been applied in the past 3 or 4 years. The subsoil is medium acid or strongly acid. The subsoil generally has a high supply of available phosphorus and a very low supply of available potassium. This soil has fair tilth. It tends to puddle if worked when it is wet and to crust after hard rains. Seedling emergence and development are retarded if crusting occurs prior to emergence.

Most areas are used for parks, lawns, and gardens and as industrial and residential building sites. The Fayette soil is suited to grasses, flowers, vegetables, trees, and shrubs and to use as building sites. If a public sewer system is not available, this soil is poorly suited to use as residential sites because of the steepness of the slope. Soil erosion is a hazard if the soil is disturbed and left bare for a considerable period. Maintaining a good vegetative cover, such as grass, can reduce soil losses and increase the infiltration of water. Temporary measures, such as silt fences, diversion terraces, and sediment control basins can be used during construction to reduce excessive runoff and keep streets, gutters, and storm sewers free of sediment.

Where sites have been leveled for buildings, a drainage system with proper outlets helps carry excess surface and subsurface water away from buildings. If basements are constructed, a tile system may be needed to prevent wetness, particularly in areas near drains, and to help stabilize the foundation, particularly in areas of shale or glacial till. The areas where cuts have been made may need to be stabilized to prevent slumps after heavy rainfall. The slumps are caused by water movement through the moderately permeable loess overlying the slowly permeable, red clayey glacial till or gray clayey shale.

Interpretations given for this map unit may differ from those given for the individual components. Onsite investigation is needed to determine physical and chemical properties, kinds of parent material, depth to underlying material, and depth to the water table. Evaluation of sites is needed to determine the proper design for individual uses and to implement corrective measures.

This complex was not assigned to a capability subclass.

5030—Pits, quarries. This map unit consists of pits that are 30 to 150 feet deep or more. Some have nearly vertical walls. The pits are irregular in shape, and their size ranges from a few acres to 30 acres. They are in areas where limestone has been quarried mainly for road construction and for use as agricultural lime.

Some of the pits contain water that ranges in depth from a few feet to many feet. The water is pumped out during quarrying.

Piles of spoil, ranging in height from a few feet to more than 30 feet, surround many of the pits. The spoil consists of soil material that derived from silty loess sediment, loamy glacial till, or eolian sandy material. The texture varies but is loamy in most places and is mixed with varying amounts of limestone fragments. The material ranges from slightly acid to moderately alkaline.

In most places, the piles of spoil have not been leveled or smoothed. The surface is very uneven. Vacated quarries and spoil piles generally become vegetated with trees and grass over a period of time. The areas, however, are difficult to revegetate without land leveling.

The areas have good potential for use as habitat for wildlife. Those areas in trees provide good habitat for woodland wildlife, especially deer.

This map unit was not assigned to a capability subclass.

5040B—Orthents, loamy, 0 to 5 percent slopes. This map unit consists of level to gently sloping soils in borrow areas and cut and fill areas. In some places, the original soil has been removed to a depth of 5 to 25 feet or more. In other places, the topsoil has been redistributed. Drainage in these areas is highly variable and is directly related to the kind of material in which the soils formed and to the condition of the areas, some of which have been restored. The areas range from excessively drained to somewhat poorly drained. Individual areas are square, rectangular, or irregular in shape and range from 2 to 30 acres in size. Many areas are along major highways and roads, and some areas are near industrial sites outside the city of Dubuque.

The soil material is quite variable, but typically in the upper 5 feet it is yellowish brown, friable and firm loam. In some areas, the color is grayish brown or light brownish gray or the texture is sandy loam. In some areas, 3 to 6 inches of topsoil has been unevenly distributed. The color of the surface in these areas ranges from very dark grayish brown to grayish brown; there are pockets of brown subsoil material. In some places, the texture is silt loam.

Included in mapping are areas of gray clayey calcareous shale. These areas are wet and seepy and may pond water for short periods. It is difficult to establish seedings and to operate machinery in these areas. Also included are small sandy areas that are 5 to 20 percent gravel. These areas are droughty and have a low available water capacity. In some places, red clayey glacial till is at or near the surface. These areas are low in fertility and cause surrounding areas to be wet and seepy. In some areas, enough overburden has been removed to expose limestone bedrock. The exposed bedrock makes tilling difficult and makes the soil too droughty for seedings to be established. The included areas make up 5 to 10 percent of the map unit.

The permeability of these Orthents is variable but generally is moderate to slow. The available water capacity ranges from moderate to low. The soil material that once was 5 to 25 feet or more below the surface and is now at the surface has less pore space and higher density than the original surface layer. Many areas are compacted by the equipment used in cutting and filling. Surface runoff is slow to medium. The content of organic matter is less than 0.5 percent except where good topsoil has been distributed over the area. Reaction is typically acid, but in some areas it is mildly alkaline. In most places, Orthents are very low in available phosphorus and potassium. They have poor tilth. They tend to puddle if worked when they are wet and to crust after heavy rains.

Most areas of these soils are idle or are seeded to hay and pasture. These soils generally are not suited to cultivated crops; they are better suited to hay and pasture. Special seeding and fertilizer are needed for a satisfactory plant cover. In the more sloping areas, these soils are subject to erosion if they are cultivated.

In some areas the soils are suited to use as habitat for wildlife or to use as woodland. Special care is needed in selecting species of plants adaptable to the soil conditions at a specific site.

Onsite investigation is needed to determine the physical and chemical properties. Interpretations based on these properties may differ from those given for individual soils in Dubuque County.

This map unit was not assigned to a capability subclass.

5040D—Orthents, loamy, 5 to 14 percent slopes. This map unit consists of gently sloping to strongly sloping soils in borrow areas and cut and fill areas on sloping embankments. In some places, the original soil has been removed to a depth of 5 to 25 feet or more to stabilize the embankment in undisturbed areas. Drainage in these areas is highly variable and is directly related to the kind of material in which the soils formed and to the condition of the areas, some of which have been restored. The areas range from excessively drained to somewhat poorly drained. Individual areas are rectangular or irregular in shape and range from 2 to 10 acres in size. Many areas are along major highways and roads, and some areas are near industrial sites outside the city of Dubuque.

The soil material is quite variable, but typically in the upper 5 feet it is yellowish brown, friable and firm loam. In some areas, the color is grayish brown or light brownish gray or the texture is sandy loam. In some areas, 3 to 6 inches of topsoil has been unevenly distributed. The color of the surface in these areas ranges from very dark grayish brown to grayish brown; there are pockets of brown subsoil material. In some places, the texture is silt loam.

Included in mapping are areas where gray clayey calcareous shale is at the lower part of embankments. These areas are wet and seepy and may cause surrounding areas to perch water for short periods. In these wet and seepy areas, it is difficult to establish seedings and to operate machinery. Also included are small sandy areas that are 5 to 20 percent gravel. These areas are droughty and have a low available water capacity. In some places, red clayey glacial till is at or near the surface. These areas are low in fertility and cause surrounding areas to be wet and seepy. The included areas make up 5 to 10 percent of the map unit.

The permeability of these Orthents is variable but generally is moderate to slow. The available water capacity ranges from moderate to low. The soil material that once was 5 to 25 feet or more below the surface and is now at the surface has less pore space and higher density than the original surface layer. Many areas are compacted by the equipment used in cutting and filling. Surface runoff is rapid to very rapid. The content of organic matter is less than 0.5 percent except where good topsoil material has been distributed over the area. Reaction is typically acid, but in some areas it is mildly alkaline. In most areas, Orthents are very low in available phosphorus and potassium. They have poor tilth. They tend to puddle if worked when they are wet and to crust after heavy rains.

Most areas of these soils are idle or are seeded to hay and pasture. These soils generally are too steep for cultivated crops or hay; they are better suited to pasture. Special seeding and fertilizer are needed for a satisfactory plant cover. The soils are subject to severe erosion if they are not managed properly.

In some areas the soils are suited to use as habitat for wildlife or to use as woodland. Special care is needed in selecting species of plants adaptable to the soil conditions at a specific site.

Onsite investigation is needed to determine the physical and chemical properties. Interpretations based

Figure 13. This area of Psamments-Urban land complex, 0 to 2 percent slopes, along the Mississippi River, is known as Industrial Island. It is within the city of Dubuque.

on these properties may differ from those given for individual soils in Dubuque County.

This map unit was not assigned to a capability subclass.

5070—Psamments-Urban land complex, 0 to 2 percent slopes. This complex consists of areas where material dredged from the Mississippi River has been deposited. These areas have been built up to cover the old 'Peosta Channel' and to form what is now called the Industrial Island of the city of Dubuque (fig. 13). The areas are protected from flooding by a dike along the Mississippi River, but an unprotected area on Ham Island, east of Dubuque, is subject to flooding. The individual areas of Psamments and of Urban land are so small or so intricately mixed that it was not practical to map them separately. The mapped areas consist of 60 to 85 percent Psamments and 15 to 40 percent Urban land. There are two large mapped areas. They are broad and irregular in shape and extend along the Mississippi River within the city of Dubuque.

The soil material is quite variable. Typically, in the upper 5 feet it is yellowish brown, loose, medium and coarse sand that is 30 to 50 percent fine gravel.

Permeability of the Psamments is rapid or very rapid. Surface runoff is slow. The available water capacity is very low. The content of organic matter is less than 0.5 percent. Typically, the reaction is acid to neutral, but in some areas it is mildly alkaline. Psamments generally are very low in available phosphorus and potassium.

Most areas are used for industrial development, but some areas are used for recreation purposes. In many areas, a plant cover surrounds buildings, but droughtiness is a threat during most of the growing season. Irrigation, however, can be used on Psamments because the water infiltration rate is good, but special seeding and fertilizer are needed for a satisfactory plant cover. In some years, water may pond in some protected areas equal to river levels during high flooding because the coarse materials in the soils allow for rapid water movement. Pumping or diverting the excess water during these periods may be necessary.

Onsite investigation is needed to determine the physical and chemical properties. Interpretations based on these properties may differ from those given for individual soils in Dubuque County.

This map unit was not assigned to a capability subclass.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in 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 economically to produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs 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 43,570 acres in Dubuque County, or about 11 percent of the total acreage, meets the soil requirements for prime farmland. Nearly all of this prime farmland is used for crops. The crops grown on this land, mainly corn and soybeans, account for an estimated 10 to 15 percent of the county's total agricultural income each year. Most of the corn grown in the county, however, is fed to livestock.

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 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.

In 1982, according to the Iowa Annual Farm Census, 243,070 acres in Dubuque County was used for cultivated crops and 37,704 acres for pasture. Corn, oats, legume-grass hay, and soybeans were the main crops.

Soil erosion is the major problem on more than 85 percent of the cropland and pasture in the county. Measures that control erosion are needed on Backbone, Bassett, Burkhardt, Chelsea, Downs, Dubuque, Exette, Fayette, Kenyon, Lamont, Lindley, Marlean, Nordness, Olin, Orwood, Rockton, Rollingstone, Rozetta, Sparta, Tama, and Winneshiek soils.

Loss of the surface layer through erosion reduces the productivity of soils and results in sedimentation in streams. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils having a subsoil that is low in fertility, such as Bassett and Kenyon soils, and on soils having a layer in or below the subsoil that restricts the root zone. An example of this kind of layer is the bedrock underlying Backbone, Nordness, Rockton, and Winneshiek soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Burkhardt, Chelsea, and Sparta soils. Control of erosion helps to maintain the productivity of the soils. It also improves the quality of water for municipal use, for recreation, and for fish and other kinds of wildlife by minimizing the pollution of streams.

Preparing a good seedbed and tilling are difficult on severely eroded soils, because the original friable silt loam surface soil has been eroded away. For example, the exposed silty clay loam subsoil of the severely eroded Fayette soils is hard and cloddy after it has been worked when wet.

Measures that control erosion provide a pretective plant cover, reduce runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the surface can reduce soil losses to an amount that will not decrease the productive capacity of the soils. On livestock farms, where part of the acreage is hayland, including grasses and legumes in the cropping system not only provides nitrogen and improves tilth for the following crops but also helps to control erosion on the more sloping soils.

A system of conservation tillage, which leaves crop residue on the surface, is effective in controlling erosion. No-till is a system in which the seedbed is prepared and the seed planted in one operation. The surface is disturbed only in the immediate area of the planted seed row. A protective cover of crop residue is left on at least 90 percent of the surface. Strip-till or till-plant also is a system in which the seedbed is prepared and the seed planted in one operation. Tillage is limited to a strip not wider than one-third of the row. A protective cover of crop residue is left on two-thirds of the surface. Chisel-disk or rotary tillage is a system in which the soil is loosened throughout the field and part of the crop residue is incorporated in the soil. Preparing the seedbed and planting may be simultaneous or separate operations. Conservation tillage is effective only if the amount of crop residue left on the surface after planting is enough to control erosion (fig. 14).

Terraces and diversions reduce the length of the slope and thereby reduce the rate of runoff and the risk of erosion. They are most practical on deep, well drained soils that have long, uniform slopes. Downs, Fayette, and Tama soils generally are well suited to terracing. Other soils are less suitable for terraces and diversions because slopes are irregular or are too steep or because bedrock is within a depth of 40 inches. Terracing is not practical on Burkhardt, Chelsea, 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, which leaves crop residue on the surface, are effective in controlling erosion.

Figure 14.—Conservation tillage is an effective method of controlling soil erosion on this moderately sloping Downs soil. The crop is corn. The residue is the preceding year's cornstalks.

Contour farming and contour stripcropping help 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.

Soil blowing is a hazard on the sandy Chelsea and Sparta soils. It can be controlled by a plant cover, surface mulch, or tillage methods that keep the surface rough.

Controlling erosion is difficult on Bassett, Kenyon, and Olin soils, because the loamy upper part of these soils is more rapidly permeable than the glacial till in the lower part of the subsoil and in the substratum. Water tends to move more rapidly through the upper part and then 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. On these soils a combination of terracing and tilling is needed. Also, gully control structures and grassed waterways are needed in the watercourses.

Soil drainage is a minor management concern in Dubuque County. Very poorly drained to somewhat poorly drained soils make up less than 10 percent of the total acreage. Moderately well drained soils need drainage only when cultivated with better drained soils.

The design of both surface and subsurface drainage systems varies with the kind of soil. Surface drains and measures that control runoff from 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.

Soil fertility is affected by the supply of available phosphorus and potassium in the subsoil, by reaction, and by the content of organic matter. The supply of available phosphorus and potassium is low or very low in most of the 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 to grow well. The poorly drained Clyde and somewhat poorly drained Floyd soils generally are neutral.

In most of the medium textured, well drained upland soils that formed under forest vegetation, the content of organic matter is about 1 to 2 percent in the surface layer. In the eroded soils, however, it generally is less than 1 percent. In the medium textured, well drained soils that formed under grasses and trees, such as Downs soils, the content of organic matter is about 2 to 3 percent. It is about 3 to 4 percent in the medium textured soils that formed under grasses, such as Kenyon and Tama soils. Generally, it is less than 1 percent in the coarse textured upland soils, and it is 7 to 11 percent in the poorly drained or very poorly drained upland soils, such as Clyde soils.

The soils that formed in alluvium on bottom lands are neutral or mildly alkaline. The soils generally have a low or very low supply of available phosphorus and potassium in the subsoil. The content of organic matter is about 1 percent in Dorchester soils and 2 to 3 percent in Otter soils.

Applications of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth generally are high in content of organic matter and are granular and porous.

Pasture and hay crops that are suited to the soils and climate in Dubuque County include several legumes, cool-season grasses, and warm-season grasses. Most of the soils in the county currently being used for permanent pasture are in bluegrass or bromegrass. Other cool-season grasses that are well adapted to the area include orchardgrass, tall fescue, timothy, and reed canarygrass.

Alfalfa is the most common legume grown for hay. It is also used in mixtures with orchardgrass, bromegrass, or timothy for hay and pasture. Birdsfoot trefoil is used in mixtures of bluegrass, orchardgrass, or timothy for pasture. Other legumes adapted to the area for pasture use are crownvetch, ladino, alsike clover, and red clover.

Warm-season grasses adapted to the county are switchgrass, big bluestem, and indiangrass. These grasses produce well during the summer, but require a special management system for establishment and grazing.

Good grazing management is necessary for high production of all pasture species. It is especially important on steeply sloping soils to prevent surface compaction and gully erosion. Proper management practices for established stands include adequate fertilization, weed and brush management, rotational or deferred grazing, proper stocking, and adequate watering facilities for livestock.

If cultivated crops are to be grown prior to seeding, soil losses can be reduced by using conservation tillage, contouring, and grassed waterways. In addition, interseeding and no-tilling grasses and legumes into existing sod will eliminate the need of destroying vegetative cover for seedbed preparation.

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 are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that 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 limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, 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

Woodland takes up about 50,307 acres in Dubuque County, or nearly one-eighth of the total acreage of the county. Trees provide products for sale or for use on the farm. They also help prevent erosion and give protection to wildlife.

Trees formerly covered nearly all of Dubuque County except for areas between Farley, Dyersville, and Worthington and other scattered areas in the southwestern part of the county that were covered by prairie grasses. Woodland was highly valued by the early settlers, who used the trees for building material and fuel. Only the best trees were harvested. Gradually, the less desirable trees dominated the woodland and reduced its economic value. Some of the wooded soils, notably the Dubuque, Exette, Fayette, and Lindley soils, were cleared for farming. Much of this acreage is now severely eroded and needs to be replanted to suitable trees if longtime profitable use is to be made of this land.

The present pattern of tree cover can be related to the six soil associations in the county. The largest proportion of wooded areas is in association 1, Fayette-Nordness. In other soil associations there are occasional woodlots, and trees are scattered along drainageways, fence rows, and on farmsteads. In many places, the wooded soils in association 1 are 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 Mississippi and Little Maquoketa Rivers and the North Branch of the Maquoketa River is not suited to crops and is only poorly suited to pasture. In these areas, present tree stands are extremely important for controlling erosion. Also, the towering limestone bluffs surrounded by trees make these areas among the most scenic of any in the state.

Native woodlands still in existence can be kept relatively productive by good management practices, including protection from livestock and fire; group selective cutting, thinning, and planting; and 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 and cause excessive erosion. Their browsing damages or kills young trees and the undergrowth. Wooded areas, if used for grazing, generally do not provide enough forage to be desirable as pasture.

The management of a wooded area depends on its present 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 periodically every 5 to 10 years. Some woodland, however, may be of such poor quality that the best procedure is to convert it from hardwoods to the relatively more valuable conifers. Before such conversion, competition from inferior species of trees and shrubs must be eliminated by mowing or by spraying them with some type of chemical brush killer.

Except for walnut logs, the demand for trees for lumber is not great. Although there are several sawmills in this county, they often are operated part time. The supply of logs for sawmills is usually obtained by taking selected cuttings from a number of sites, rather than harvesting the trees from an entire tract.

Several agencies in Iowa can assist woodland owners in improving and marketing their product. The Soil Conservation Service can help woodland owners determine which soils are suitable for trees and what conservation treatment is needed. State foresters can assist in developing plans for managing new or old stands of trees.

Soils differ in their capability for use as woodland. The factors that influence such use are somewhat different and less restrictive than those that limit the use of soils for cultivated crops. The soil survey can help the owner of a wooded tract determine where he can get the best returns for his investment in woodland management. If the soils are good for trees, the owner can afford to spend time and money in managing his woodland carefully. Little management, other than that needed to protect the soils, however, is justified on poor sites. Some factors that are important in woodland management are discussed 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 Nordness-Rock outcrop complex.

Aspect, or direction of exposure. Forest studies show a definite relationship between the exposure of a site and the rate of tree growth. Trees generally grow better and make better yields on slopes facing north and east and on gently sloping or nearly level valley flats and broad ridgetops than on slopes facing south or west. Long, steep slopes that have various exposures are typical of soils and land types such as the Fayette and Nordness soils and 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. Pines need a slightly acid soil. Most species of pine, especially the native species, are poorly suited to soils that are high in lime. On the other hand, hardwoods commonly grow well on those soils. Eastern redcedar is also tolerant of lime. Caneek and Dorchester soils contain excess lime in the upper 2 to 3 feet. Most of the other bottom land soils in Dubuque County are neutral in reaction. Hardwoods should not be planted on eroded or depleted soils and generally are poorly suited to old, formerly cultivated soils, whereas pine grows fairly well on these poorer sites.

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 suitable 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 in terms of cubic meters of wood per hectare per year. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate;

and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive 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; and *f*, high content of coarse fragments in the soil profile. 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, and f.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, reduce energy requirements, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To 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 expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

There are many parks and recreation areas throughout the county that provide camping, picnicking, and hiking. Most of the cities and towns have at least one local park, such as Swiss Valley Park near Dubuque (fig. 15). There are also several wildlife preserves and nature centers in Dubuque County, such as White Pine Hollow State Preserve near Luxemburg and E.B. Lyons Nature Center near Dubuque. Practically all parks are owned by local and state governments.

In many of the rural areas, there are opportunities for hunting and fishing along rivers and creeks, and especially along the Mississippi River. Water skiing and boating are also extensive along the Mississippi River. In many areas, the small creeks, in addition to part of the Little Maquoketa River, are spring-fed and are cold enough to be stocked with trout. Many of these areas are in the parks of Dubuque County. Trees and limestone bluffs line many of the rivers and creeks. In the fall, the colorful leaves of the trees attract many tourists.

Figure 15.—Picnic areas are common in Dubuque County and offer scenic enjoyment to many users. This one is in Swiss Valley Park.

In Dubuque County, the deep valleys and the long to short hilly slopes provide excellent opportunities for downhill and cross-country skiing and snowmobile activities during the snowy winter season. Many of the county parks offer cross-country skiing, and the private sector provides downhill skiing.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock 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

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, 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. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, 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 or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by 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 or stones, 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 or by toxic substances in the root zone, such as high content of calcium carbonate. Availability of drainage outlets is not considered in the ratings.

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 classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

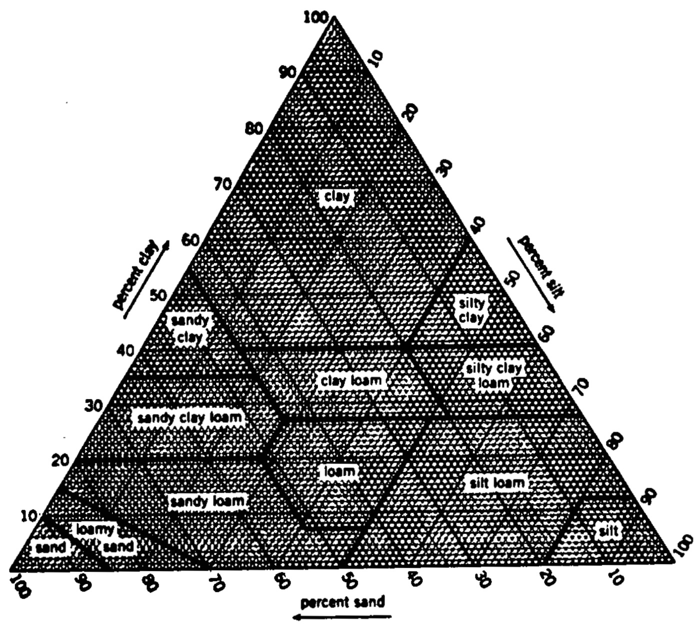

Figure 16.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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 in the fraction of the soil that is less than 2 millimeters in diameter (fig. 16). "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 (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

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. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

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; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered 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 the 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 is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*24*). 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. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is 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 Aquent (*Aqu*, meaning water, 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 Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

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

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed (calcareous), mesic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*23*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*24*). 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."

Arenzville Series

The Arenzville series consists of moderately well drained, moderately permeable soils on bottom lands. These soils formed in 20 to 40 inches of recent, stratified silty alluvium over an older buried soil. The native vegetation was trees. The slope ranges from 0 to 2 percent.

Arenzville soils are similar to Chaseburg soils and are commonly adjacent to Chaseburg, Fayette, Nordness, and Orion soils. Chaseburg soils do not have a buried soil in the upper 40 inches and are slightly lower on the landscape than Arenzville soils. Dorchester soils formed in calcareous stratified alluvium. Fayette soils are well drained and formed in loess on the surrounding uplands. Nordness soils are well drained, are underlain by limestone at a depth of 8 to 20 inches, and are on side slopes and escarpments on uplands. Orion soils are somewhat poorly drained and are upslope along the upper drainageways.

Typical pedon of Arenzville silt loam, 1 to 2 percent slopes, in a cultivated field on bottom lands; 2,540 feet east and 520 feet south of the northwest corner of sec. 35, T. 88 N., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

C1—rito 24 inches; stratified dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2) silt loam; appears massive but parts to weak thin to thick platy fragments; friable; neutral; clear smooth boundary.

C2—24 to 36 inches; stratified dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2) silt loam; common fine faint dark brown (7.5YR 3/2) mottles; appears massive but parts to weak thin to thick platy fragments; friable; neutral; clear smooth boundary.

Ab1—36 to 45 inches; black (10YR 2/1) silt loam; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

Ab2—45 to 55 inches; very dark gray (10YR 3/1) silt loam; weak fine subangular blocky structure; friable; few fine brown (7.5YR 4/4) concretions (iron oxide); neutral; clear smooth boundary.

C—55 to 60 inches; dark gray (10YR 4/1) silt loam; few fine distinct olive (5Y 5/3) and olive brown (2.5Y 4/4) mottles; massive; friable; few very dark gray (10YR 3/1) coatings on root channels; few fine brown (7.5YR 4/4) concretions (iron oxide); neutral.

Depth to the buried Ab horizon ranges from 20 to 40 inches. The 10- to 40-inch control section on the average is 10 to 18 percent clay. In some pedons, the Ab horizon is more than 18 percent clay. The soil typically is neutral or mildly alkaline, but in some pedons the Ap horizon is slightly acid. Color, arrangement, and thickness of all horizons are quite variable because of the source of sediment and the method of deposition.

The Ap or A horizon typically is dark grayish brown (10YR 4/2), but it includes strata with value of 3 through 5 and chroma of 3 or 4. The C horizon between the Ap or A1 and 2Ab horizons is always stratified. Colors of the C horizon dominantly have hue of 10YR, value of 3 to 6, and chroma of 2 or 3.

The Ab horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It typically is silt loam, but in some pedons it is silty clay loam. The underlying C horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Typically, the C horizon consists of stratified silty sediment, but in some pedons the C horizon is 10 to 15 percent chert and gravel.

Atterberry Series

The Atterberry series consists of somewhat poorly drained, moderately permeable soils on upland divides, at the head of drainageways, and at the base of slopes. These soils formed in more than 60 inches of loess. The native vegetation was mixed grasses and trees. The slope ranges from 1 to 3 percent.

Atterberry soils are similar to Coppock soils and are commonly adjacent to Downs, Muscatine, and Tama soils. Coppock soils formed in alluvium. Downs and Tama soils are well drained. They are more sloping than Atterberry soils and are upslope. Muscatine soils have a thicker A horizon and are in higher positions on the same landscape.

Typical pedon of Atterberry silt loam, 1 to 3 percent slopes, in a cultivated field on a west-facing concave upland side slope; 860 feet west and 395 feet south of the northeast corner of sec. 6, T. 89 N., R. 2 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky and granular structure; friable; medium acid; clear smooth boundary.

E1—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate thin platy structure; friable; medium acid; clear smooth boundary.

E2—11 to 14 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; moderate thin platy structure; friable; medium acid; clear smooth boundary.

BE—14 to 19 inches; brown (10YR 4/3) silt loam (26 percent clay); few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; discontinuous light gray (10YR 7/2) (dry) silt coatings; medium acid; clear smooth boundary.

Bt—19 to 25 inches; brown (10YR 6/3) silty clay loam; few fine faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; few discontinuous grayish brown (10YR 5/2) clay films; discontinuous light gray (10YR 7/2) (dry) silt coatings; medium acid; clear smooth boundary.

Btg—25 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine angular blocky and subangular blocky structure; friable; few discontinuous grayish brown (10YR 5/2) clay films;

discontinuous white (10YR 8/2) (dry) silt coatings; medium acid; clear smooth boundary.

BCg—36 to 46 inches; light brownish gray (2.5Y 6/2) silty clay loam (28 percent clay); common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium and fine prismatic structure; friable; few discontinuous grayish brown (10YR 5/2) clay films; discontinuous white (10YR 8/2) (dry) silt coatings; medium acid; clear smooth boundary.

Cg—46 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; common fine prominent strong brown (7.5YR 5/8) mottles; massive with some vertical cleavage; friable; few grayish brown (10YR 5/2) coatings in root channels; medium acid.

The thickness of the solum ranges from 40 to 60 inches.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 6 to 10 inches thick. The E horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) and is 4 to 8 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. It is silty clay loam and ranges in clay content from 27 to 32 percent. The BC horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 1 or 2; it has high chroma mottles. The B horizon is medium acid to strongly acid.

Backbone Series

The Backbone series consists of moderately deep, somewhat excessively drained, permeable soils on upland ridgetops and side slopes. These soils formed in 20 to 40 inches of loamy eolian sediment and in thin residuum over limestone bedrock. The native vegetation was mixed grasses and trees. Permeability is moderately rapid in the loamy sediment and moderately slow in the residuum. The slope ranges from 5 to 14 percent.

These soils are taxadjuncts to the Backbone series because they do not have the needed clay increase for an argillic horizon in the loamy eolian material that is defined in the range for the Backbone series. This difference, however, does not alter the use or behavior of the soils.

Backbone soils are commonly adjacent to Lamont, Sogn, and Winneshiek soils. Lamont soils formed in more than 40 inches of loamy eolian sediment and are upslope on the landscape. Sogn soils formed in less than 20 inches of sediment over limestone, have a mollic epipedon, and are lower on the landscape than Backbone soils. Winneshiek soils formed in 20 to 40 inches of sediment over limestone and are upslope.

Typical pedon of Backbone fine sandy loam, 5 to 9 percent slopes, in a cultivated field on a west-facing convex upland side slope; 1,110 feet east and 440 feet south of the northwest corner of sec. 1, T. 87 N., R. 2 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak thin platy structure; very friable; medium acid; abrupt smooth boundary.

Bw1—7 to 12 inches; brown (10YR 4/3) fine sandy loam; weak fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.

Bw2—12 to 22 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; few light ray (10YR 7/2) silt coatings on peds; slightly acid; clear wavy boundary.

12Bt—22 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine prismatic structure; firm; thin discontinuous brown (7.5YR 4/4) clay films; slightly acid; abrupt wavy boundary.

2R—26 inches; hard fractured limestone.

The thickness of the solum ranges from 20 to 40 inches.

The A or Ap horizon typically is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark brown (10YR 3/3) and is 5 to 8 inches thick. The E horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). In some pedons, the E horizon is mixed into the Ap horizon. The upper part of the B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 through 5. The 2Bt horizon is 2 to 5 inches thick. It is clay loam or sandy clay loam. The B horizon is slightly acid to medium acid.

Bassett Series

The Bassett series consists of moderately well drained, moderately permeable soils on upland ridges and side slopes. These soils formed in 14 to 20 inches of loamy materials and in the underlying glacial till. The native vegetation was mixed grasses and trees. The slope ranges from 2 to 14 percent.

Bassett soils are similar to Racine soils and are commonly adjacent to Kenyon, Racine, and Schley soils. Kenyon soils have a mollic epipedon and are on broad upslope ridges. Racine soils have less clay in the Bt horizon and are downslope from Bassett soils. Schley soils have a grayer B horizon and thicker loamy sediment. They also are downslope from the Bassett soils.

Typical pedon of Bassett loam, 5 to 9 percent slopes, in a cultivated field on a southwest-facing convex side slope on uplands; 1,265 feet west and 435 feet south of the northeast corner of sec. 35, T. 88 N., R. 2 W.

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

E—8 to 14 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; comon very dark grayish brown (10YR 3/2) coatings on faces of peds; weak thin platy structure; friable; slightly acid; clear smooth boundary.

Bt1—14 to 18 inches; yellowish brown (10YR 5/4) loam (37 percent sand and 26 percent clay); weak fine subangular blocky structure; friable; few discontinuous clay films; band of pebbles one-quarter to one-half inch in diameter at 18 inches; strongly acid; clear smooth boundary.

2Bt2—18 to 24 inches; yellowish brown (10YR 5/6) clay loam (41 percent sand and 29 percent clay); moderate medium and fine subangular blocky structure; friable; few discontinuous yellowish brown (10YR 5/4) clay films; few one-quarter inch pebbles; strongly acid; gradual smooth boundary.

2Bt3—24 to 31 inches; yellowish brown (10YR 5/6) clay loam (42 percent sand and 28 percent clay); moderate medium subangular blocky structure; friable; few light gray (10YR 7/2) (dry) coatings on peds; thin continuous yellowish brown (10YR 5/4) clay films; few black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

2BC—31 to 46 inches; strong brown (7.5YR 5/6) loam (45 percent sand and 26 percent clay); few medium distinct light brownish gray (10YR 6/2) mottles; moderate medium and coarse prismatic structure; firm; continuous light gray (10YR 7/2) (dry) coatings on peds; thin discontinuous yellowish brown (10YR 5/6) clay films; few strong brown (7.5YR 5/8) concretions (iron oxide); medium acid; clear smooth boundary.

2C—46 to 60 inches; yellowish brown (10YR 5/6) loam (44 percent sand and 26 percent clay); common medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; common medium strong brown (7.5YR 5/6) concretions (iron oxide) in bands and masses; medium acid.

The thickness of the solum ranges from 40 to 60 inches. There are no carbonates in the upper 60 inches. Bassett soils commonly have a stone line that separates the loamy material and the glacial till, but in some pedons the stone line is missing.

The A or Ap horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 6 to 9 inches thick. The E horizon is dark brown (10YR 3/3), dark grayish brown (10YR 4/2), or brown (10YR 4/3) and is 3 to 6 inches thick. In cultivated areas, there may not be an E horizon.

The upper part of the B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The 2B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 6 with mottles of lower chroma. The 2B horizon typically is loam or clay loam. The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 through 6 with mottles of high and low chroma. The B horizon is medium acid or strongly acid.

Burkhardt Series

The Burkhardt series consists of excessively drained soils on stream terraces and on outwash plains on uplands. These soils formed in 12 to 24 inches of loamy and sandy material over sand and gravel. The native vegetation was grasses. Permeability is moderately rapid in the solum and rapid in the underlying material. The slope ranges from 5 to 14 percent.

The Burkhardt soils are commonly adjacent to Flagler, Ostrander, and Wapsie soils. Flagler soils are underlain by sand and gravel at a depth of 24 to 40 inches and are upslope on stream terraces. Ostrander soils formed in loamy sediment and in friable glacial drift and generally are on foot slopes below Burkhardt soils on the uplands. Wapsie soils are loamy in the upper 2 feet and have a lighter colored A horizon; they generally are above Burkhardt soils on stream terraces.

Typical pedon of Burkhardt sandy loam, 5 to 14 percent slopes, in a cultivated field on a southwest-facing convex side slope on uplands; 740 feet north and 50 feet east of the southwest corner of sec. 15, T. 87 N., R. 2 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; some streaks and pockets of dark brown (7.5YR 3/2) subsoil material; weak fine granular structure; very friable; about 12 percent 1/4- to 1-inch gravel; neutral; abrupt smooth boundary.

Bw—6 to 12 inches; dark brown (7.5YR 3/2) gravelly sandy loam, brown (7.5YR 4/2) dry; moderate fine subangular blocky structure; friable; clay bridging between sand grains and gravel; about 25 percent 1/4- to 1 1/2-inch gravel; slightly acid; gradual smooth boundary.

BC—12 to 17 inches; brown (7.5YR 4/2 and 4/4) gravelly loamy sand; weak fine subangular blocky structure; very friable; about 25 percent 1- to 2-inch gravel; few fragments of soft mealy limestone; slightly acid; clear smooth boundary.

2C1—17 to 47 inches; yellowish brown (10YR 5/6) coarse sand; single grained; loose; about 12 percent 1/2- to 2-inch gravel; slightly acid; gradual smooth boundary.

2C2—47 to 60 inches; strong brown (7.5YR 5/6) stratified sand and gravel; single grained; loose; brown (7.5YR 5/4) 1- to 2-inch bands of gravel; slightly acid.

The solum typically is 14 to 24 inches thick but may be as thin as 12 inches.

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4, but hue of 5YR is not excluded. The 2C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand or gravelly sand. The B horizon is slightly acid to medium acid.

Caneek Series

The Caneek series consists of poorly drained, moderately permeable soils on low bottom lands. These soils formed in recent calcareous, stratified alluvium. The native vegetation was trees. The slope ranges from 0 to 2 percent.

Caneek soils are similar to Dorchester soils and are commonly adjacent to Dorchester and Medary soils. Dorchester soils are moderately well drained, are browner in color in the upper part, and are above Caneek soils on flood plains of valley streams. Medary soils are moderately well drained; they formed in clayey lacustrine alluvium on terrace-bench escarpments upslope from Caneek soils.

Typical pedon of Caneek silt loam, 0 to 2 percent slopes, in a grassy park on a level flood plain; 560 feet west and 310 feet north of the southeast corner of sec. 10, T. 90 N., R. 2 E.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam with grayish brown (10YR 5/2) strata, light brownish gray (10YR 6/2) dry; few fine distinct brown (7.5YR 4/4) mottles; weak thin platy and weak fine granular structure because of stratification; friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

Cg1—4 to 25 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; common fine distinct brown (7.5YR 4/4) mottles; appears massive but parts to moderate thin platy fragments; friable; slight effervescence; moderately alkaline; clear smooth boundary.

Cg2—25 to 31 inches; stratified dark gray (10YR 4/1) and gray (10YR 5/1) silt loam; common fine prominent reddish brown (5YR 4/4) mottles; appears massive but parts to weak thin platy fragments; friable; slight effervescence; mildly alkaline; gradual smooth boundary.

Cg3—31 to 40 inches; stratified dark gray (5Y 4/1) and olive gray (5Y 5/2) silt loam; common fine prominent reddish brown (5YR 4/4) mottles in the upper part; appears massive but parts to weak thin platy fragments; friable; neutral; abrupt wavy boundary.

Ab—40 to 60 inches; black (10YR 2/1) silty clay loam; massive; friable; neutral.

Depth to the Ab horizon ranges from 30 to 40 inches. Generally, there are carbonates throughout the C horizon, but in some places there are no carbonates in the lower part. There are no carbonates in the Ab horizon. Color arrangement and thickness of all horizons are quite variable because of the source of sediment and the method of deposition.

The C horizon dominantly has hue of 10YR, value of 4 or 5, and chroma of 1 or 2, but hue of 5Y is not excluded. The C horizon is always stratified and has distinct or prominent mottles. Typically, the C horizon is silt loam, but in places there may be thin strata of loam. Typically, the C horizon is mildly alkaline or moderately alkaline, but in the lower part in some pedons it is neutral. The Ab horizon is silt loam or silty clay loam. The Ab horizon is more than 10 inches thick and is neutral or mildly alkaline.

Chaseburg Series

The Chaseburg series consists of moderately well drained, moderately permeable soils on bottom lands. These soils formed in recent, stratified silty alluvium. The native vegetation was trees. The slope ranges from 0 to 5 percent.

Chaseburg soils are similar to Arenzville soils and are comonly adjacent to Arenzville, Coppock, Fayette, Lawson, and Nordness soils. Arenzville soils have a buried soil in the upper 40 inches and are in slightly higher positions on bottom lands than Chaseburg soils. Coppock and Lawson soils are more poorly drained and are in slightly higher positions upslope. Fayette soils are well drained and formed in loess on the surrounding uplands. Nordness soils are well drained, are underlain by limestone at a depth of 8 to 20 inches, and are on upland side slopes and escarpments.

Typical pedon of Chaseburg silt loam, 0 to 2 percent slopes, in a cultivated field on nearly level bottom lands; 1,880 feet west and 530 feet north of the southeast corner of sec. 5, T. 89 N., R. 2 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 3/4) silt loam, light gray (10YR 7/2) and pale brown (10YR 6/3) dry; weak fine subangular blocky and granular structure; friable; few thin brown (10YR 5/3) strata; neutral; abrupt smooth boundary.

C1—7 to 25 inches; dark grayish brown (10YR 4/2) silt loam; appears massive but parts to moderate thin platy fragments; friable; few thin grayish brown (10YR 5/2) strata; neutral; clear smooth boundary.

C2—25 to 46 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam with few yellowish red (5YR 4/6) coatings; appears massive but parts to moderate thin platy fragments; friable; few thin very dark grayish brown (10YR 3/2) strata; 3-inch sandy loam lens at 40 inches; neutral; clear smooth boundary.

C3—46 to 60 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; massive with horizontal cleavage; friable; few thin sandy loam lenses in the lower part; neutral.

The A or Ap horizon is 6 to 10 inches thick and is silt loam. The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. Dominant colors of the underlying C horizon are dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2), but some strata with chroma of 3 or 4 are within the range of the series. Strata of 10YR 2/1, 3/1, or 3/2, however, are not excluded if they are not part of a buried soil. The C horizon centers on silt loam, but there may be strata of silty clay loam, loam, or sandy loam. The sandy loam strata are thin and generally occur below a depth of 40 inches. Reaction ranges from slightly acid to neutral throughout the solum.

Chelsea Series

The Chelsea series consists of excessively drained, rapidly permeable soils on upland ridgetops, side slopes, and escarpments. These soils formed in eolian sandy sediment more than 48 inches thick. The native vegetation was trees. The slope ranges from 5 to 25 percent.

Chelsea soils are similar to Sparta soils and are commonly adjacent to Lamont and Sogn soils. Lamont soils formed in loamy eolian sediment and are upslope on the landscape. Sogn soils formed in 8 to 20 inches of loamy sediment over limestone and are downslope from Chelsea soils. Sparta soils have a thicker and darker A horizon than that of Chelsea soils.

Typical pedon of Chelsea loamy fine sand, 5 to 9 percent slopes, in a hay field on a southwest-facing convex side slope on uplands; 2,520 feet east and 120 feet south of the northwest corner of sec. 1, T. 87 N., R. 2 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) loamy fine sand, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky structure; very friable; medium acid; abrupt smooth boundary.

E1—9 to 16 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak thick platy structure parting to very weak fine subangular blocky; very friable; medium acid; clear smooth boundary.

E2—16 to 27 inches; yellowish brown (10YR 5/4) fine sand, very pale brown (10YR 7/3) dry; very weak medium platy structure; very friable; slightly acid; gradual smooth boundary.

E3—27 to 37 inches; light yellowish brown (10YR 6/4) fine sand, very pale brown (10YR 7/3) dry; very weak thin platy structure; very friable; strongly acid; gradual smooth boundary.

E and Bt—37 to 60 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; brown (7.5YR 4/4) sandy loam iron bands at a depth of 41 to 43 inches, 45 to 46 inches, and 57 to 58 inches; medium acid.

The thickness of the solum ranges from 48 to more than 72 inches.

The A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 3 to 6 inches thick. The Ap horizon is dark brown (10YR 3/3), dark grayish brown (10YR 4/2), or brown (10YR 4/3). Some pedons do not have an Ap horizon. The texture of the A horizon typically is loamy fine sand, but the range includes fine sand. The E horizon has chroma of 3 or 4 in the upper part and value and chroma of 4 to 6 in the lower part. Depth to the uppermost sandy loam or loamy sand lamellae (iron bands) is 30 to 45 inches.

Clyde Series

The Clyde series consists of poorly drained, moderately permeable soils along drainageways and in lower concave positions on uplands. These soils formed in loamy material and in the underlying glacial till, which is at a depth of 30 to 50 inches. The native vegetation was grasses. The slope ranges from 0 to 2 percent.

Clyde soils are similar to Marshan soils and are commonly adjacent to Floyd, Marshan, and Schley soils. Floyd and Schley soils are somewhat poorly drained and have a browner B horizon than that of Clyde soils. Floyd and Schley soils are on concave side slopes above Clyde soils. Marshan soils formed in 24 to 40 inches of loamy alluvium over sandy alluvium and are downslope lower on the landscape.

Typical pedon of Clyde loam, 0 to 2 percent slopes, in a cultivated field in a northwest-facing concave drainageway on uplands; 195 feet east and 265 feet south of the center of sec. 2, T. 88 N., R. 2 W.

Ap—0 to 7 inches; black (N 2/0) loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—7 to 16 inches; black (10YR 2/1) loam (25 percent clay), very dark gray (10YR 3/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

BA—16 to 22 inches; dark gray (5Y 4/1) loam (26 percent clay), gray (5Y 5/1) dry; few fine distinct light olive brown (2.5Y 5/6) mottles; weak fine subangular blocky structure; friable; very dark gray (5Y 3/1) coatings on faces of peds; neutral; clear smooth boundary.

Bg1—22 to 33 inches; grayish brown (2.5Y 5/2) clay loam (28 percent clay); common fine distinct light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; friable; discontinuous dark gray (N 4/0) clay films; sandy clay loam band at 29 to 33 inches; neutral; abrupt smooth boundary.

2Bg2—33 to 43 inches; grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/8) loam (26 percent clay); weak medium prismatic structure; firm; neutral; gradual smooth boundary.

2Cg—43 to 60 inches; gray (5Y 5/1) loam (26 percent clay); few medium prominent brownish yellow (10YR 6/8) mottles; massive with vertical cleavage faces; firm; few fine reddish brown (5YR 4/4) concretions (iron and manganese oxide); neutral.

The thickness of the solum ranges from 36 to 60 inches. Depth to carbonates ranges from about 50 to more than 60 inches.

Thickness of the A horizon ranges from 20 to 24 inches. Typically, the A horizon is clay loam or loam, but the range includes silt loam high in sand. The Bg horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is clay loam or loam, but in many pedons there are thin strata of sandy loam or silty clay loam. The lower part of the B horizon and the C horizon are similar in texture to the Bg1 horizon. The B horizon is neutral or slightly acid.

Coppock Series

The Coppock series consists of somewhat poorly drained, moderately permeable soils on low stream terraces. These soils formed in silty alluvium more than 60 inches thick. The native vegetation was mixed grasses and trees. The slope ranges from 0 to 2 percent.

Coppock soils are similar to Atterberry soils and are commonly adjacent to Arenzville, Chaseburg, Festina, Lawson, and Otter soils. Arenzville and Chaseburg soils are moderately well drained, do not have a B horizon, and are on bottom lands. Atterberry soils formed in loess on uplands. Festina soils are well drained and are slightly higher on the landscape than the Coppock soils. Lawson soils and the poorly drained Otter soils have a thicker A horizon and are on bottom lands.

Typical pedon of Coppock silt loam, 0 to 2 percent slopes, in a cultivated field on a level alluvial terrace; 400 feet west and 2,120 feet north of the southeast corner of sec. 13, T. 88 N., R. 1 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; friable; neutral; abrupt smooth boundary.

E—9 to 17 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) and light brownish gray (10YR 6/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate thin platy structure; friable; medium acid; clear smooth boundary.

BE—17 to 21 inches; grayish brown (10YR 5/2) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few thin discontinuous silt coatings on faces of peds; medium acid; clear smooth boundary.

Btg1—21 to 29 inches; grayish brown (2.5Y 5/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; friable; few thin discontinuous gray (10YR 5/1) clay films on faces of peds; strongly acid; clear smooth boundary.

Btg2—29 to 36 inches; grayish brown (2.5Y 5/2) silt loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine angular blocky; friable; few thick continuous light brownish gray (2.5Y 6/2) clay films on faces of peds; strongly acid; clear smooth boundary.

Btg3—36 to 48 inches; light brownish gray (2.5Y 6/2) silty clay loam; many fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; friable; few very dark gray (10YR 3/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

Btg4—48 to 60 inches; mottled gray (5Y 6/1) and brown (7.5YR 5/4) silty clay loam; weak coarse prismatic structure; friable; few very dark gray (10YR 3/1) concretions (manganese oxide); medium acid.

The solum is 40 to 70 inches thick.

The A or Ap horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2) and is 6 to 9 inches thick. The E horizon is 8 to 15 inches thick. The Bt horizon is dark grayish brown (2.5Y 4/2 or 10YR 4/2) or grayish brown (2.5Y 5/2 or 10YR 5/2) and has common or many mottles in chroma of 3 or more. The lower part of the B horizon and the C horizon are light brownish gray (10YR 6/2), gray (5Y 6/1), or brown (7.5YR 5/4). The B horizon is medium acid to strongly acid.

Dickinson Series

The Dickinson series consists of somewhat excessively drained, moderately rapidly permeable soils on uplands and on terraces along streams. These soils formed in loamy eolian sediment. The native vegetation was grasses. The slope ranges from 2 to 12 percent.

Dickinson soils are similar to Olin soils and are commonly adjacent to Marlean, Olin, Ostrander, Orwood, and Sparta soils. Marlean soils formed in loamy eolian sediment over cherty disjointed limestone and are upslope from Dickinson soils. Olin soils have glacial till at a depth of 2 to 3 feet, and they also are upslope. Ostrander soils are finer in texture in the A and B horizons than Dickinson soils; Ostrander soils formed in glacial till and are upslope. Orwood soils formed in eolian sediment that is finer in texture than that of Dickinson soils, have a thinner A horizon and are generally on the upper part of side slopes. Sparta soils are coarser in texture than Dickinson soils and are downslope on escarpments and on the higher knolls.

Typical pedon of Dickinson fine sandy loam, 5 to 12 percent slopes, in a permanent pasture on a northeast-facing convex side slope on uplands; 325 feet south and 360 feet east of the northwest corner of sec. 15, T. 87 N., R. 1 W.

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

A1—8 to 12 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

A2—12 to 16 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

Bw1—16 to 22 inches; brown (10YR 4/3) fine sandy loam; weak fine and medium subangular blocky structure; very friable; dark brown (10YR 3/3) coatings on faces of peds; medium acid; gradual smooth boundary.

Bw2—22 to 32 inches; brown (10YR 5/3) fine sandy loam; weak fine subangular blocky structure; very friable; medium acid; gradual smooth boundary.

BC—32 to 44 inches; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) loamy fine sand; weak medium prismatic structure; very friable; medium acid; gradual smooth boundary.

C—44 to 60 inches; dark yellowish brown (10YR 4/4) loamy fine sand; single grained; loose; very friable; medium acid.

The thickness of the solum ranges from 24 to 48 inches.

The A horizon is 12 to 20 inches thick. It has hue of 10YR, value of 2 to 3, and chroma of 1 to 3. The B horizon ranges from dark brown (10YR 3/3) to brown (10YR 4/3) in the upper part and from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/4 to 5/6) in the lower part. The B horizon is slightly acid to strongly acid. The C horizon is yellowish brown (10YR 5/4 to 10YR 5/6). It ranges from loamy sand to fine sand. In some pedons, the C horizon has few lamellae of sandy loam or loamy sand 1/4 to 1 inch thick below a depth of 40 inches.

Dorchester Series

The Dorchester series consists of moderately well drained, moderately permeable soils on bottom lands. These soils formed in recent calcareous, stratified silty alluvium. The native vegetation was trees. The slope ranges from 0 to 2 percent.

Dorchester soils are similar to Caneek soils and are commonly adjacent to Caneek, Medary, Nordness, Volney, and Zwingle soils. Caneek soils are poorly drained and are on the lower stream bottom lands. Medary soils formed in clayey lacustrine sediment and are upslope on escarpments of high stream benches. Nordness soils are well drained, are underlain by limestone at a depth of 8 to 20 inches, and are upslope on upland escarpments and side slopes. Volney soils formed in channery loamy alluvium and are on foot slopes. Zwingle soils are poorly drained and formed in clayey lacustrine sediment on high stream terraces.

Typical pedon of Dorchester silt loam, 0 to 2 percent slopes, in a permanent pasture on a flood plain; 2,840 feet east and 2,280 feet south of the northwest corner of sec. 28, T. 90 N., R. 2 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam with very dark grayish brown (10YR 3/2) strata, brown (10YR 4/3) rubbed, light brownish gray (10YR 6/2) dry; weak thin platy and weak fine granular structure due to stratification; friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1—5 to 17 inches; stratified dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) rubbed, light brownish gray (10YR 6/2) dry; appears massive but parts to weak thin platy fragments; friable; slight effervescence; moderately alkaline; clear smooth boundary.

C2—17 to 28 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam with thin strata that are very dark grayish brown (10YR 3/2), light brownish gray (10YR 6/2), and very pale brown (10YR 7/3) dry; few fine faint grayish brown (10YR 5/2) mottles; appears massive but parts to weak thin platy fragments; friable; few fine strong brown (7.5YR 5/6) iron stains; slight effervescence; mildly alkaline; clear wavy boundary.

Ab—28 to 60 inches; black (10YR 2/1) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles in the upper part; very weak fine subangular blocky structure; friable; slight effervescence; mildly alkaline.

Depth to the Ab horizon typically ranges from 25 to 45 inches. In some pedons there is no Ab horizon. Free carbonates are present throughout the C horizon.

The C horizon typically is dark grayish brown (10YR 4/2) or brown (10YR 5/3), but the range includes very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3) (thin strata). Typically the C horizon is silt loam, but there may be thin strata of loam. The Ab horizon typically is silt loam, but the range includes silty clay loam and clay loam. The Ab horizon is neutral or mildly alkaline.

Downs Series

The Downs series consists of well drained, moderately permeable soils on upland ridges and side slopes and on stream benches. These soils formed in loess more than 60 inches thick. The native vegetation was mixed grasses and trees. The slope ranges from 2 to 18 percent.

The Downs soils are similar to Festina, Newvienna, and Orwood soils and are commonly adjacent to Atterberry, Dubuque, Ely, Newvienna, Orwood, and Tama soils. Atterberry soils are somewhat poorly drained, have a grayer B horizon than that of the Downs soils, and are at the head of drainageways and on upland divides. Dubuque soils are underlain by limestone at a depth of 20 to 40 inches and are on lower side slopes. Ely soils are somewhat poorly drained, formed in silty alluvium, and are on foot slopes at the base of the uplands. Festina soils formed in silty alluvium and are downslope on low stream terraces. Newvienna soils are moderately well drained and have mottles at 24 to 30 inches. Newvienna soils are at the head of drainageways and on side slopes along drainageways. Orwood soils formed in loamy eolian sediment and are on lower side slopes. Tama soils have a thicker mollic epipedon, do not have an E horizon, and are upslope from Downs soils.

Typical pedon of Downs silt loam, 5 to 9 percent slopes, in a cultivated field on a lower convex ridgetop; 1,000 feet west and 295 feet south of the northeast corner of sec. 14, T. 87 N., R. 1 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

BE—9 to 16 inches; brown (10YR 4/3) silt loam (26 percent clay); weak medium and fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bt1t—16 to 23 inches; yellowish brown (10YR 5/4) silty clay loam (29 percent clay); weak medium and fine subangular blocky structure; friable; light gray (10YR 7/2) (dry) silt coatings on peds; few thin discontinuous very dark grayish brown (10YR 3/2) clay films; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.

Bt2—23 to 32 inches; yellowish brown (10YR 5/4) silty clay loam (32 percent clay); weak medium subangular blocky structure parting to moderate fine angular blocky; friable; light gray (10YR 7/2) (dry) silt coatings on peds; few thin discontinuous dark brown (10YR 3/3) clay films; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

Bt3—32 to 40 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); moderate medium subangular blocky structure; friable; light gray (10YR 7/2) (dry) silt coatings on peds; few thin continuous brown (10YR 4/3) clay films; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.

Bt4—40 to 47 inches; yellowish brown (10YR 5/4) silt loam (26 percent clay); few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; white (10YR 8/2) (dry) silt coatings on peds; few thin discontinuous brown (10YR 4/3) clay films; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.

Bt5—47 to 51 inches; yellowish brown (10YR 5/4) silt loam; few fine faint yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; few thin discontinuous brown (10YR 4/3) clay films; few fine very dark brown (10YR 2/2) concretions (manganese oxide); medium acid; clear smooth boundary.

BC—51 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine faint pale brown (10YR 6/3) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; friable; few thin discontinuous brown (10YR 4/3) clay films; few fine yellowish red (5YR 5/6) concretions (iron oxide) at 59 inches; medium acid.

The thickness of the solum ranges from 42 to more than 60 inches.

The A or Ap horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2) and is 6 to 9 inches thick. In some pedons there is an E horizon. The E horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). When the soil is dry, light gray to white silt coatings are readily apparent in the E and B horizons. The upper part of the B horizon commonly is brown (10YR 4/3) and grades to value of 4 or 5 and chroma of 4 to 6 with increasing depth. In the B horizon, there are no low chroma mottles to a depth of 32 inches. In some pedons, there are low chroma mottles below a depth of 32 inches because of relict conditions. The finest textured material in the B horizon is silty clay loam that is 27 to 35 percent clay. The sand content typically is less than 10 percent. Reaction in the most acid part of the B horizon is medium acid or strongly acid.

Dubuque Series

The Dubuque series consists of moderately deep, well drained, moderately permeable soils on upland side slopes. These soils formed in 20 to 30 inches of loess and thin limestone residuum over hard limestone. The native vegetation was trees. The slope ranges from 9 to 18 percent.

Dubuque soils are commonly adjacent to Downs, Fayette, Nordness, and Rollingstone soils. Downs and

Fayette soils formed in more than 60 inches of loess and are upslope. Nordness soils are underlain by limestone at a depth of 8 to 20 inches and are on lower side slopes and escarpments. Rollingstone soils formed in 5 to 15 inches of loess and the underlying cherty limestone residuum and are downslope from Dubuque soils.

Typical pedon of Dubuque silt loam, 20 to 30 inches to limestone, 9 to 14 percent slopes, in a permanent pasture on an east-facing convex ridgetop on uplands; 1,480 feet east and 285 feet north of the center of sec. 22, T. 90 N., R. 1 W.

A—0 to 3 inches; very dark gray (10YR 3/1) silt loam with some dark grayish brown (10YR 4/2), gray (10YR 6/1) dry; moderate fine granular structure grading to weak thin platy structure in the lower part; friable; common fine roots; thin discontinuous coatings of light gray (10YR 7/1) clean silt and sand grains on surface of platy structure; slightly acid; abrupt smooth boundary.

E1—3 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate thin platy structure; friable; few fine roots; thin nearly continuous coatings of light gray (10YR 7/1) clean silt grains on faces of peds; slightly acid; clear smooth boundary.

E2—8 to 11 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; few discontinuous brown (10YR 4/3) coatings on faces of peds and thin nearly continuous light gray (10YR 7/1) coatings of silt grains on faces of peds; medium acid; clear smooth boundary.

Bt1—11 to 16 inches; yellowish brown (10YR 5/4) silt loam, faces of peds brown (10YR 5/3); weak fine subangular and angular blocky structure; friable; thin discontinuous light gray (10YR 7/1) coatings of silt grains on faces of peds; medium acid; clear smooth boundary.

2Bt2—16 to 22 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine angular and subangular blocky structure; friable; few thin discontinuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/1) coatings of silt grains on faces of peds; medium acid; abrupt wavy boundary.

2Bt3—22 to 27 inches; brown (7.5YR 4/4) clay, faces of peds reddish brown (5YR 4/4), brown (7.5YR 4/4) kneaded; moderate fine and medium angular and subangular blocky structure; very firm; thick continuous dark brown (7.5YR 3/2) clay films; few dark reddish brown (5YR 4/4) and yellowish red (5YR 4/6) coatings on faces of peds; few small chert fragments; medium acid; abrupt wavy boundary.

2R—27 inches; less than 1 inch of soft very pale brown (10YR 7/3) fragmented limestone over hard level bedded limestone. Some of the limestone fragments can be separated and have small amounts of reddish clayey material between them.

The thickness of the solum and the depth to limestone typically are 20 to 30 inches, but the range is to 40 inches.

In undisturbed sites, the A horizon is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and is 2 to 4 inches thick. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 5/3). Some pedons do not have an E horizon. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 through 6 and is silt loam or silty clay loam. The 2Bt horizon is silty clay or clay, commonly has some chert or limestone fragments, and is 1 to 5 inches thick. It typically has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 3 through 6.

Eleroy Series

The Eleroy series consists of moderately well drained soils on side slopes near drainageways and on toe slopes on uplands. These soils formed in 30 to 50 inches of loess and residuum of calcareous clayey shale. The native vegetation was trees. Permeability is moderate in the loess and very slow in the shale. The slope ranges from 9 to 18 percent.

Eleroy soils are similar to Rozetta soils and are commonly adjacent to Nordness, Rozetta, and Schapville soils. Rozetta soils are underlain by material that weathered from shale at a depth of 5 to 10 feet and are upslope on the same landscape. Nordness soils are underlain by limestone at a depth of 8 to 20 inches and are on lower side slopes and escarpments. Schapville soils formed in 15 to 30 inches of loess or silty material and in material that weathered from shale. They are downslope on the steeper side slopes and along concave drainageways.

Typical pedon of Eleroy silt loam in an area of Rozetta-Eleroy silt loams, 9 to 14 percent slopes, in a cultivated field on a west- to southwest-facing convex side slope on uplands; 1,320 feet south and 120 feet east of the northwest corner of sec. 8, T. 90 N., R. 1 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) and pale brown (10YR 6/3) dry; about 20 percent pockets of yellowish brown (10YR 5/4) silty clay loam (subsoil material); weak fine subangular blocky and moderate thin platy structure; friable; few dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; abrupt smooth boundary.

Bt1—7 to 11 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); moderate fine subangular blocky structure; friable; few dark grayish brown (10YR 4/2) coatings on peds; thin discontinuous brown (10YR 4/3) clay films; neutral; clear smooth boundary.

Bt2—11 to 18 inches; yellowish brown (10YR 5/4) silty clay loam (30 percent clay); few fine distinct pale brown (10YR 6/3) and few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky and angular blocky structure; friable; thin discontinuous brown (10YR 5/3) clay films; neutral; clear smooth boundary.

Bt3—18 to 28 inches; mottled light olive brown (2.5YR 5/4) and yellowish brown (10YR 5/6) silty clay loam (30 percent clay); weak medium and coarse subangular blocky structure; friable; few thin discontinuous brown clay films; few dark grayish brown (10YR 4/2) clay flows in root channels; few strong brown (7.5YR 5/6) concretions (iron oxide); few very dark gray (10YR 3/1) concretions (manganese oxide); neutral; gradual smooth boundary.

BC—28 to 40 inches; light olive brown (2.5Y 5/4) and pale brown (10YR 6/3) silty clay loam (28 percent clay); weak coarse prismatic structure; friable; few yellowish brown (10YR 5/8) concretions (iron oxide); few very dark gray (10YR 3/1) concretions (manganese oxide); few fine soft limestone fragments; neutral; clear smooth boundary.

2C—40 to 44 inches; brown (7.5YR 4/4) silty clay loam (30 percent clay); few fine distinct light yellowish brown (2.5YR 6/4) mottles; massive; friable; few soft and hard limestone fragments about 1 inch in diameter; slight effervescence; mildly alkaline.

2Cr—44 to 60 inches; greenish gray (5GY 6/1) and pale olive (5Y 6/4) clayey calcareous shale.

The thickness of the solum ranges from 40 to 55 inches. Depth to firm calcareous shale is 40 to 60 inches. but in some pedons shale is at a depth of only 3 feet.

The Ap horizon is dark brown (10YR 3/3), dark grayish brown (10YR 4/2), brown (10YR 4/3), or grayish brown (10YR 5/2) and is 4 to 7 inches thick. In uncultivated areas, the A horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2) and is 3 to 7 inches thick. In some pedons there is an E horizon. The E horizon is 2 to 8 inches thick and is brown (10YR 4/3 or 5/3) or grayish brown (10YR 5/2). In cultivated areas, the E horizon may be mixed into the Ap horizon. The A and E horizons are generally silt loam.

The B horizon has hue of 10YR and 2.5Y, value of 5, and chroma of 3 through 6. The lower part of the B horizon is mottled with both high-and low-chroma mottles. The BC horizon can have hue of 2.5Y. Typically, the B horizon formed in loess, but in some pedons it formed partly in shale.

Ely Series

The Ely series consists of somewhat poorly drained, moderately permeable soils on narrow upland foot slopes. These soils formed in silty colluvium. The native vegetation was grasses. The slope ranges from 2 to 5 percent.

Ely soils are similar to Lawson and Worthen soils and are commonly adjacent to Downs, Otter, and Tama soils. Lawson soils have less clay throughout the solum than Ely soils. Downs and Tama soils are well drained, have a thinner A horizon, and formed in more than 60 inches of loess on upland side slopes. Otter soils are poorly drained and formed in silty stratified alluvium on bottom lands. Worthen soils are well drained.

Typical pedon of Ely silt loam, 2 to 5 percent slopes, in a cultivated field on a southwest-facing convex foot slope; 430 feet west and 920 feet south of the northeast corner of sec. 28, T. 87 N., R. 1 E.

Ap—0 to 7 inches; black (10YR 2/1) silt loam (26 percent clay), dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A1—7 to 16 inches; black (10YR 2/1) silty clay loam (29 percent clay), dark gray (10YR 4/1) dry; weak fine granular and subangular blocky structure; friable; medium acid; clear smooth boundary.

A2—16 to 24 inches; black (10YR 2/1) silty clay loam (30 percent clay), dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; friable; medium acid; clear smooth boundary.

AB—24 to 32 inches; very dark brown (10YR 2/2) silty clay loam (29 percent clay), very dark grayish brown (10YR 4/2) dry; moderate medium and fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bg1—32 to 37 inches; dark grayish brown (10YR 4/2) silty clay loam (29 percent clay); few fine distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; friable; very dark gray (10YR 3/1) coatings on faces of peds; slightly acid; clear smooth boundary.

Bg2—37 to 42 inches; grayish brown (10YR 5/2) silty clay loam (30 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; friable; thin discontinuous dark grayish brown (10YR 4/2) silt coatings on peds; neutral; clear smooth boundary.

Bg3—42 to 47 inches; grayish brown (2.5Y 5/2) silty clay loam (28 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; friable; thin discontinuous dark grayish brown (10YR 4/2) silt coatings on peds; neutral; clear smooth boundary.

BCg—47 to 57 inches; grayish brown (2.5Y 5/2) silt loam (24 percent clay); few fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak medium prismatic structure; friable; thin discontinuous grayish brown (10YR 5/2) silt coatings on faces of peds; neutral; clear smooth boundary.

C—57 to 60 inches; grayish brown (2.5Y 5/2) silt loam; few fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive with some vertical cleavage; friable; neutral.

The thickness of the solum typically is more than 48 inches but ranges from 40 to 60 inches. Generally, there are no carbonates above 5 feet, but in some pedons there may be some at a depth of 4 feet.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1) and is 24 to 36 inches thick. The A horizon is silt loam or silty clay loam.

The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4 with mottles in hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 through 8. The BC or C horizons are grayish brown (10YR 5/2 or 2.5Y 5/2) with mottles in hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 8. The B horizon is neutral to medium acid.

Exette Series

The Exette series consists of well drained, moderately permeable soils on upland side slopes. These soils formed in loess more than 60 inches thick. The native vegetation was trees. The slope ranges from 14 to 25 percent.

Exette soils are commonly adjacent to Downs, Fayette, and Orion soils. Downs soils have a mollic epipedon, do not have mottling within a depth of 30 inches, and are upslope from Exette soils. Fayette soils do not have mottling in the upper 30 inches, have a B horizon of silty clay loam, and are upslope on the surrounding landscape. Orion soils are poorly drained, formed in alluvium, and are downslope along drainageways.

Typical pedon of Exette silt loam, 18 to 25 percent slopes, moderately eroded, in a cultivated field on a convex upland side slope; 175 feet east and 1,220 feet north of the southwest corner of sec. 1, T. 88 N., R. 1 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; some pockets of yellowish brown (10YR 5/4) silt loam (subsoil material); weak fine granular structure; friable; neutral; abrupt smooth boundary.

Bw1—7 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; few dark grayish brown (10YR 4/2) coatings on faces of peds; one-half inch by three-quarters inch reddish brown (5YR 4/4) pipe stems; neutral; clear smooth boundary.

Bw2—13 to 20 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct grayish brown (10YR 5/2) mottles; weak medium and fine angular blocky structure; friable; few medium and fine yellowish red (5YR 4/6) concretions (iron oxide); slightly acid; clear smooth boundary.

BC—20 to 30 inches; light brownish gray (10YR 6/2) silt loam; weak medium subangular blocky structure; friable; few thin discontinuous grayish brown (10YR 5/2) silt coatings on peds; common medium and fine yellowish red (5YR 4/6) concretions (iron oxide); few one-quarter by one-half inch reddish brown (5YR 4/4) pipe stems; neutral; clear smooth boundary.

C1—30 to 47 inches; light brownish gray (2.5YR 6/2) silt loam; massive; friable; few medium reddish brown (5YR 4/4) concretions (iron oxide); few fine irregular lime accumulations; strong effervescence; mildly alkaline; clear smooth boundary.

C2—47 to 60 inches; light brownish gray (2.5Y 6/2) and light olive brown (2.5Y 5/4) silt loam; massive; friable; few coarse and medium yellowish red (5YR 4/8) concretions (iron oxide); common fine lime concretions; strong effervescence; mildly alkaline.

The solum commonly is 30 to 45 inches thick, but it can be only as thick as 25 inches. There are no carbonates in the solum.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The Bw and BC horizons have hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. Relict mottles in the upper 30 inches range from 7.5YR to 2.5Y in hue, 4 to 6 in value, and 2 through 8 in chroma. The percentage of mottles in chroma of 2 is at least 20 in the upper 30 inches. Clay content ranges from 22 to 26 percent in the Ap, BE, and Bw horizons and from 15 to 20 percent in the BC and C horizons. Sand content is less than 5 percent throughout the solum. Reaction of the B horizon ranges from neutral to medium acid in the most acid part.

Fayette Series

The Fayette series consists of well drained, moderately permeable soils on upland ridges and side slopes. These soils formed in loess more than 60 inches thick. The native vegetation was trees. The slope ranges from 2 to 40 percent.

Fayette soils are similar to Seaton soils and are commonly adjacent to Arenzville, Chaseburg, Downs, Dubuque, Exette, Nordness, and Rozetta soils. Arenzville and Chaseburg soils formed in alluvium and are downslope along drainageways. Downs soils have a thicker and darker A horizon than that of Fayette soils and are on less sloping ridges. Dubuque soils formed in

20 to 40 inches of loess and residuum over limestone and are on the lower part of side slopes. Exette soils have relict gray mottles in the upper 30 inches. Exette soils are on side slopes below Fayette soils. Rozetta soils are moderately well drained, have mottles at a depth of 24 to 30 inches, and are underlain by shale at a depth of 5 to 10 feet. They are on the lower part of side slopes on the Maquoketa Shale Formation. Nordness soils are underlain by limestone at a depth of 8 to 20 inches and are on the lower part of side slopes and escarpments. Seaton soils have less clay in the subsoil than Fayette soils.

Typical pedon of Fayette silt loam, 9 to 14 percent slopes, in a permanent pasture on a northeast-facing convex upland side slope; 340 feet west and 2,280 feet south of the northeast corner of sec. 25, T. 87 N., R. 1 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—3 to 5 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate thin platy structure; friable; slightly acid; clear smooth boundary.

E2—5 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak thin platy structure parting to weak fine subangular blocky; friable; medium acid; clear smooth boundary.

BE—10 to 15 inches; yellowish brown (10YR 5/4) silt loam; moderate medium and fine angular and subangular blocky structure; friable; very pale brown (10YR 7/3) (dry) silt coatings on peds; medium acid; clear smooth boundary.

Bt1—15 to 25 inches; yellowish brown (10YR 5/4) silty clay loam (30 percent clay); moderate medium and fine angular blocky structure; friable; light gray (10YR 7/2) (dry) silt coatings on peds; few thin discontinuous clay films; strongly acid; clear smooth boundary.

Bt2—25 to 35 inches; yellowish brown (10YR 5/4) silty clay loam (33 percent clay); strong medium and fine angular blocky structure; friable; light gray (10YR 7/2) (dry) silt coatings on peds; few thin discontinuous brown (10YR 4/3) clay films; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

Bt3—35 to 40 inches; yellowish brown (10YR 5/4) silty clay loam (31 percent clay); moderate medium angular blocky structure; friable; white (10YR8/2) (dry) silt coatings on peds; few thin discontinuous brown (10YR 4/3) clay films; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

Bt4—40 to 46 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); moderate medium prismatic structure parting to moderate medium and fine angular blocky; friable; white (10YR 8/2) (dry) silt coatings on peds; few thin discontinuous brown (10YR 4/3) clay films; few fine yellowish red (5YR 4/6 and 5/8) concretions (iron oxide); few fine black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

BC—46 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine faint light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure; friable; white (10YR 8/2) (dry) silt coatings on peds; few thin discontinuous brown (10YR 4/3) clay films; few fine yellowish brown (10YR 5/8) concretions (iron oxide); few fine black (10YR 2/1) concretions (manganese oxide); slightly acid.

The thickness of the solum ranges from 40 to 60 inches. There are no carbonates in the upper 60 inches.

The A horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2) and is 3 to 7 inches thick. It is silt loam; in some eroded areas it is silty clay loam. The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3) and is 5 to 9 inches thick. The E horizon is brown (10YR 4/3 or 5/3) or dark grayish brown (10YR 4/2) and is 2 to 10 inches thick. In some cultivated areas, the E horizon is incorporated into the Ap horizon.

The upper part of the B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The lower part of B horizon has hue of 10YR, value of 5 or 6, and chroma of 4 through 6. The Bt horizon typically is silty clay loam with clay content ranging from 28 to 35 percent. Reaction is strongly acid or very strongly acid in the most acid part of the B horizon.

The C horizon is generally yellowish brown (10YR 5/4 or 5/6). Generally, there are mottles in hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 or 3 below a depth of 3 feet.

Festina Series

The Festina series consists of well drained, moderately permeable soils on low stream terraces. These soils formed in silty alluvium. The native vegetation was mixed grasses and trees. The slope ranges from 1 to 5 percent.

Festina soils are similar to Downs soils and are commonly adjacent to Coppock and Wapsie soils. The somewhat poorly drained and poorly drained Coppock soils have a grayer B horizon than that of the Festina soils and are in lower lying positions on the same landscape. Downs soils formed in loess. Wapsie soils are loamy and are underlain by sand and gravel. They are slightly higher on the landscape than Festina soils.

Typical pedon of Festina silt loam, 1 to 5 percent slopes, in a cultivated field; 2,490 feet west and 565 feet north of the southeast corner of sec. 26, T. 87 N., R. 2 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; some grayish brown (10YR 5/2) streaks and pockets; moderate fine subangular blocky and granular structure; friable; slightly acid; abrupt smooth boundary.

E1—6 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate thin platy structure; friable; thin discontinuous light gray (10YR 7/2) (dry) silt coatings on peds; slightly acid; clear smooth boundary.

E2—9 to 15 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate thin platy structure; friable; thin discontinuous light gray (10YR 7/2) (dry) silt coatings on peds; slightly acid; clear smooth boundary.

BE—15 to 23 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silt loam; moderate fine angular blocky structure; friable; thin discontinuous light gray (10YR 7/2) (dry) silt coatings on peds; medium acid; clear smooth boundary.

Bt1—23 to 31 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silt loam; moderate fine angular blocky structure; friable; brown (10YR 4/3) coatings on faces of peds; thin discontinuous clay films; thin discontinuous light gray (10YR 7/2) (dry) silt coatings on peds; medium acid; clear smooth boundary.

Bt2—31 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam (30 percent clay); moderate fine angular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films; thin discontinuous light gray (10YR 7/2) (dry) silt coatings on peds; medium acid; clear smooth boundary.

Bt3—36 to 43 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure; friable; thin discontinuous brown (10YR 4/3) clay films; medium acid; clear smooth boundary.

C—43 to 60 inches; stratified grayish brown (10YR 5/2) and light brownish gray (2.5Y 6/2) silt loam with yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) fine sandy loam; massive; dark brown (7.5YR 3/2) iron bands one-quarter to one-half inch in thickness; friable; slightly acid.

The thickness of the solum typically is about 43 inches, but it ranges from 36 to 60 inches. There are no carbonates within a depth of 70 inches or more.

The Ap horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The E horizon typically is 4 to 10 inches thick. In some pedons it may be partly mixed into the Ap horizon. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 through 6. The B horizon is silt loam or silty clay loam. There is sand stratification below a depth of 40 inches in most pedons.

Flagler Series

The Flagler series consists of somewhat excessively drained soils on stream terraces and outwash plains. These soils formed in 2 to 3 feet of loamy sediment and in the underlying sandy alluvium. The native vegetation was grasses. Permeability is moderately rapid in the upper part of the solum and very rapid in the lower part of the solum and the substratum. The slope ranges from 2 to 5 percent.

Flagler soils are commonly adjacent to Burkhardt, Sparta, and Wapsie soils. Burkhardt soils formed in 12 to 24 inches of loamy sediment over sand and gravel and are downslope on escarpments. Sparta soils are excessively drained; they formed in eolian sandy deposits and are upslope from Flagler soils. Wapsie soils are well drained; they formed in loamy alluvium, and they also are upslope.

Typical pedon of Flagler sandy loam, 2 to 5 percent slopes, in a cultivated field on a southwest-facing stream terrace; 20 feet west and 35 feet south of the northwest corner of sec. 5, T. 88 N., R. 2 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; very few one-half inch chert fragments; neutral; abrupt smooth boundary.

A—7 to 11 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; very few one-half inch chert fragments; neutral; clear smooth boundary.

AB—11 to 15 inches; dark brown (10YR 3/3) and dark yellowish brown (10YR 3/4) sandy loam, brown (10YR 5/3) and yellowish brown (10YR 5/4) dry; weak medium and fine subangular blocky structure; very friable; neutral; clear smooth boundary.

Bw1—15 to 22 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sandy loam; weak medium and fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.

Bw2—22 to 30 inches; brown (7.5YR 4/4) sandy loam; very weak medium subangular blocky structure; very friable; very few one-half inch gravel pebbles; slightly acid; clear smooth boundary.

2BC—30 to 38 inches; brown (7.5YR 4/4) loamy sand; very weak fine subangular blocky structure; very friable; few gravel and chert fragments one-quarter to one-half inch in diameter; slightly acid; gradual smooth boundary.

2C1—38 to 43 inches; dark yellowish brown (10YR 4/4) sand; single grained; loose; about 5 to 7 percent chert and gravel fragments; medium acid; clear smooth boundary.

2C2—43 to 60 inches; yellowish brown (10YR 5/6) sand; single grained; loose; 5 to 10 percent gravel one-quarter to one-half inch in diameter and chert fragments one-half to one inch in diameter; medium acid.

The thickness of the solum ranges from 24 to 40 inches. Depth to sandy alluvium typically is 24 to 33 inches but ranges from 20 to 36 inches. Generally, there are no carbonates withib a depth of 6 feet or more.

The A or Ap horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 through 6. Average clay content ranges from 10 to 15 percent. Total sand content of the Bw horizon typically is 60 to 70 percent, and content of fine to coarse sand ranges from 45 to 65 percent. The 2C horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. The 2C horizon is loamy sand or sand, and some strata are 20 to 50 percent gravel. The Bw horizon typically is slightly acid to strongly acid.

Floyd Series

The Floyd series consists of somewhat poorly drained, moderately permeable soils on upland toe slopes and at the head of drainageways. These soils formed in 30 to 45 inches of stratified glacial sediment and the underlying glacial till. The native vegetation was grasses. The slope ranges from 1 to 4 percent.

Floyd soils are similar to Schley soils and are commonly adjacent to Clyde, Kenyon, Ostrander, Rockton, and Schley soils. Clyde soils are poorly drained and are downslope in concave positions on the landscape. Kenyon soils are moderately well drained and are upslope from Floyd soils. Ostrander soils are well drained and are upslope from Floyd soils and downslope from Kenyon sois. Rockton soils are well drained; they formed in 20 to 40 inches of loamy sediment over limestone and are generally upslope. Schley soils have an E horizon and are on higher toe slopes along drainageways.

Typical pedon of Floyd loam, 1 to 4 percent slopes, in a cultivated field on a north-facing convex upland foot slope near a drainageway; 1,260 feet west and 2,220 feet north of the southeast corner of sec. 3, T. 88 N., R. 2 W.

Ap—0 to 7 inches; black (N 2/0) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—7 to 15 inches; very dark gray (N 3/0) loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

AB—15 to 19 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few very dark gray (10YR 3/1) coatings on faces of peds; neutral; clear smooth boundary.

Bw1—19 to 23 inches; dark grayish brown (2.5Y 4/2) loam; weak fine subangular blocky structure; friable; few very dark grayish brown (2.5Y 3/2) coatings on faces of peds; neutral; clear smooth boundary.

Bw2—23 to 31 inches; light olive brown (2.5Y 5/6) and grayish brown (2.5Y 5/2) loam (24 percent clay); few fine distinct yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

2Bw3—31 to 40 inches; yellowish brown (10YR 5/8) and light brownish gray (2.5Y 6/2) loam (26 percent clay); weak fine and medium subangular blocky structure; firm; light brownish gray (2.5Y 6/2) coatings on vertical faces of peds in the upper part; few small pebbles; neutral; gradual smooth boundary.

2BC—40 to 51 inches; yellowish brown (10YR 5/8) and light brownish gray (2.5Y 6/2) loam (26 percent clay); weak medium prismatic structure; firm; few small pebbles; neutral; clear smooth boundary.

2C—51 to 60 inches; yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) loam (26 percent clay); massive; firm; slight effervescence; mildly alkaline.

The solum ranges from about 40 to 60 inches in thickness. Depth of loamy material that is underlain by glacial till ranges from 30 to 45 inches. Reaction in the solum typically is neutral but ranges to slightly acid. Depth to carbonates ranges from 45 to 70 inches.

The A horizon is black (N 2/0 or 10YR 2/1) or very dark gray (N 3/0 or 10YR 3/1). The AB horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (2.5Y 3/2). The A horizon typically is loam, but the range includes clay loam, silty clay loam high in sand, and silt loam high in sand. The Bw horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 through 8. The B horizon is loam, clay loam, or sandy clay loam; in some pedons it has thin strata of sandy loam or loamy sand typically less than 6 inches thick.

Hayfield Series

The Hayfield series consists of somewhat poorly drained soils on outwash terraces. These soils formed in 32 to 40 inches of loamy alluvium over sandy alluvium. The native vegetation was mixed grasses and trees. Permeability is moderate in the solum and rapid in the substratum. The slope ranges from 0 to 3 percent.

Hayfield soils are commonly adjacent to Lamont, Marshan, and Wapsie soils. Lamont soils formed in loamy eolian sediment and are upslope in slightly higher positions than Hayfield soils. Marshan soils are poorly drained and are downslope. Wapsie soils are well drained and are upslope.

Typical pedon of Hayfield loam, 32 to 40 inches to sand and gravel, 0 to 3 percent slopes, in a cultivated field on a south- to southeast-facing level outwash terrace; 575 feet south and 75 feet west of the northeast corner of sec. 27, T. 87 N., R. 2 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) and black (10YR 2/1) loam, grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; slightly acid; abrupt smooth boundary.

E—6 to 12 inches; dark grayish brown (10YR 4/2) silt loam (22 percent sand and 26 percent clay), light brownish gray (10YR 6/2) and light gray (10YR 7/2) dry; moderate medium platy structure; friable; very dark grayish brown (10YR 3/2) coatings in root channels; slightly acid; clear smooth boundary.

Bt1—12 to 19 inches; brown (10YR 4/3 and 5/3) loam (24 percent sand and 26 percent clay); few fine faint brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; thin discontinuous grayish brown (10YR 5/2) clay films in root channels; slightly acid; clear smooth boundary.

Bt2—19 to 28 inches; brown (10YR 5/3) and pale brown (10YR 6/3) clay loam (28 percent sand and 30 percent clay); common fine distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few thin discontinuous grayish brown (10YR 5/2) clay films in root channels and pores; slightly acid; clear smooth boundary.

Bt3—28 to 34 inches; brown (10YR 5/3) and pale brown (10YR 6/3) sandy loam; common fine distinct strong brown (7.5YR 4/6 and 5/8) mottles; weak medium subangular blocky structure; friable; few thin discontinuous grayish brown (10YR 5/2) clay films in root channels and pores; about 5 percent pebbles one-quarter inch in diameter; medium acid; clear smooth boundary.

2C—34 to 60 inches; dark yellowish brown (10YR 4/4) coarse sand; common fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; about 5 percent pebbles one-half inch in diameter; few very dark brown (10YR 2/2) concretions (manganese oxide); slightly acid.

The thickness of the solum and depth to the 2C horizon typically range from 32 to 40 inches. Depth to carbonates ranges from 50 to 90 inches.

The Ap horizon is black (10YR 2/1), very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2) and is 5 to 10 inches thick. The E horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) and is 4 to 6 inches thick. The A and E horizons are silt loam or loam.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. The B horizon has mottles of high and low chroma. The B horizon typically is loam or silt loam that has a high content of sand in the upper part, and it is loam or clay loam in the lower part. The range, however, includes sandy loam, in a layer less than 6 inches thick, in the lower part. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 through 6. It has few to many high-chroma mottles. Typically the 2C horizon is stratified sand and gravel. The B horizon is medium acid or strongly acid in the most acid part.

Huntsville Series

The Huntsville series consists of moderately well drained, moderately permeable soils on second bottoms. These soils formed in silty alluvium more than 40 inches thick. The slope ranges from 0 to 2 percent.

Huntsville soils are similar to Worthen soils are are commonly adjacent to Chaseburg, Lawson, Otter, and Spillville soils. Chaseburg soils formed in recent stratified silty alluvium on the lower part of bottom lands. The somewhat poorly drained Lawson soils are on second bottoms and are lower on the landscape than Huntsville soils. Otter soils are poorly drained and are on flood plains at the lower elevations. Spillville soils formed in loamy alluvium and are somewhat poorly drained; they are on the lower part of bottom lands near major streams. Worthen soils have a thinner A horizon than that of Huntsville soils. Worthen soils are on foot slopes near loess-covered uplands.

Typical pedon of Huntsville silt loam, in an area of Lawson-Huntsville silt loams, 0 to 2 percent slopes, in a cultivated field on a second bottom; 1,720 feet east and 2,240 feet south of the northwest corner of sec. 31, T. 89 N., R. 2 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—10 to 20 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

A2—20 to 38 inches; very dark grayish brown (10YR 3/2) and black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) rubbed, dark grayish brown (10YR 4/2) and dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

C—38 to 60 inches; dark brown (10YR 3/3) and brown (10YR 4/3) loam; weak medium prismatic structure grading to massive with vertical cleavage; friable; brown (10YR 4/3) sandy loam strata at a depth of 56 to 60 inches; medium acid.

The thickness of the solum ranges from 36 to 50 inches. Huntsville soils formed in silty alluvium more than 40 inches thick. There are no carbonates in the upper 60 inches.

The A horizon typically is black (10YR 2/1) or very dark brown (10YR 2/2) in the upper part and very dark grayish brown (10YR 3/2) in the lower part, but the range includes dark brown (10YR 2/3). The total thickness of the A horizon is 24 to 36 inches. There is a B horizon in some pedons. It ranges from brown (10YR 4/3) to yellowish brown (10YR 5/6). The horizon is generally weakly expressed. In some pedons there are a few mottles in the lower part of the B and C horizons. The C horizon typically is loam or silt loam, but the range includes sandy loam strata. The B and C horizons are slightly acid to medium acid.

Kenyon Series

The Kenyon series consists of moderately well drained, moderately permeable soils on ridges and side slopes on uplands. These soils formed in 13 to 26 inches of loamy sediment and in the underlying glacial till. The native vegetation was grasses. The slope ranges from 2 to 9 percent.

Kenyon soils are similar to Olin and Ostrander soils and are commonly adjacent to Bassett, Floyd, Ostrander, and Rockton soils. Olin soils contain more sand in the upper part of the solum than Kenyon soils. Bassett soils have a thinner and lighter colored A horizon and are generally on the lower part of side slopes. Floyd soils are somewhat poorly drained and are on toe slopes and at the head of drainageways. Ostrander soils formed in friable and firm glacial till and are below the Kenyon soils on the landscape. Rockton soils formed in 20 to 40 inches of loamy sediment over limestone and are generally downslope from the Kenyon soils.

Typical pedon of Kenyon loam, 2 to 5 percent slopes, in a cultivated field on a convex side slope, on uplands; 250 feet north and 2,240 feet west of the southeast corner of sec. 27, T. 87 N., R. 1 E.

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

A—8 to 13 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

BA—13 to 20 inches; brown (10YR 4/3) loam; weak medium and fine subangular blocky structure; friable; dark brown (10YR 3/3) coatings on faces of peds; slightly acid; clear smooth boundary.

Bw1—20 to 26 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) loam; weak medium and fine subangular blocky structure; friable; medium acid; clear smooth boundary.

2Bw2—26 to 33 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine yellowish red (5YR 5/8) concretions (iron oxide); few 1/2- to 1-inch pebbles; medium acid; gradual smooth boundary.

2Bw3—33 to 40 inches; yellowish brown (10YR 5/4) loam; few fine faint yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine dark reddish brown (5YR 3/3) and yellowish red (5YR 5/8) concretions (iron oxide); medium acid; gradual smooth boundary.

2Bw4—40 to 48 inches; yellowish brown (10YR 5/6) loam; few fine faint yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few fine yellowish red (5YR 5/8) concretions (iron oxide); slightly acid; gradual smooth boundary.

2BC—48 to 57 inches; yellowish brown (10YR 5/4) loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium and coarse prismatic structure; firm; few fine yellowish red (5YR 5/6) concretions (iron oxide); neutral; clear smooth boundary.

2C—57 to 60 inches; yellowish brown (10YR 5/4) loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure; firm; few fine yellowish red (5YR 6/8) concretions (iron oxide); slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 45 to 60 inches.

The A or Ap horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) and typically is 10 to 16 inches thick. An eroded Ap horizon, however, is as thin as 8 inches. The A horizon is loam or silt loam that is high in sand. The 2B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 through 6, and below a depth of 30 inches it is mottled in hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 through 8. The 2B horizon is medium acid or strongly acid.

Lamont Series

The Lamont series consists of well drained, moderately rapidly permeable soils on uplands and on benches along streams. These soils formed in sand that has been deposited predominantly by wind. The native vegetation was trees. The slope ranges from 2 to 14 percent.

Lamont soils are commonly adjacent to Backbone, Chelsea, Hayfield, and Olin soils. Backbone soils formed in 20 to 40 inches of loamy eolian sediment over limestone and are downslope on the landscape. Chelsea soils have less clay in the solum than Lamont soils and are on steep escarpments downslope and on nearby higher knolls. Hayfield soils are loamy and are somewhat poorly drained; they are upslope in drains and swales. Olin soils have glacial till at a depth of 2 to 3 feet and are upslope on uplands.

Typical pedon of Lamont fine sandy loam, 2 to 5 percent slopes, in a pasture on a southwest-facing side slope on a terrace; 2,700 feet west and 920 feet north of the southeast corner of sec. 6, T. 87 N., R. 1 W.

A—0 to 4 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

E—4 to 9 inches; brown (10YR 4/3) and dark grayish brown (10YR 4/2) fine sandy loam, pale brown (10YR 6/3) dry; weak medium platy structure parting to weak fine subangular blocky; friable; few very dark gray (10YR 3/1) coatings on faces of peds; slightly acid; clear smooth boundary.

BE—9 to 13 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bt1—13 to 21 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure; friable; thin discontinuous clay flows connect some sand grains; medium acid; gradual smooth boundary.

Bt2—21 to 36 inches; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) fine sandy loam; weak coarse subangular blocky structure; very friable; few clay flows connect some sand grains; medium acid; gradual smooth boundary.

C1—36 to 46 inches; yellowish brown (10YR 5/4 and 5/6) loamy sand; single grained; loose; few one-quarter inch thick discontinuous (7.5YR 5/6) iron bands; medium acid; gradual smooth boundary.

C2—46 to 60 inches; brownish yellow (10YR 6/6) loamy sand; single grained; loose; medium acid.

The thickness of the solum ranges from 30 to 45 inches.

The A horizon is 2 to 6 inches thick. It has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The E horizon is 3 to 6 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. In some places, the E horizon is mixed into the Ap horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. In some pedons, the B horizon has few lamellae of sandy loam 1/4- to 1-inch thick and has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. The B horizon is medium acid or strongly acid in the most acid part. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. The C horizon is loamy sand or sand.

Lawson Series

The Lawson series consists of somewhat poorly drained, moderately permeable soils on second bottoms. These soils formed in silty alluvium more than 48 inches thick. The native vegetation was grasses. The slope ranges from 0 to 2 percent.

Lawson soils are similar to Ely soils and are commonly adjacent to Chaseburg, Coppock, Huntsville, and Otter soils. Chaseburg soils are moderately well drained; they formed in recent stratified silty alluvium on lower bottom lands. Coppock soils have a lighter colored A horizon than that of Lawson soils and are in slightly higher positions. Ely soils are silty clay loam. Huntsville soils are moderately well drained and are upslope. Otter soils are poorly drained and are lower on the landscape than Lawson soils. Spillville soils formed in loamy alluvium.

Typical pedon of Lawson silt loam, in an area of Lawson-Huntsville silt loams, 0 to 2 percent slopes, in a cultivated field on bottom lands; 2,400 feet east and 790 feet north of the southwest corner of sec. 30, T. 87 N., R. 1 E.

Ap—0 to 10 inches; black (10YR 2/1) and very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) rubbed, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—10 to 19 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; dark grayish brown (10YR 4/2) strata at 11 to 13 and 15 to 17 inches; neutral; clear smooth boundary.

A2—19 to 25 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; neutral; clear smooth boundary.

A3—25 to 31 inches; black (10YR 2/1) and very dark grayish brown (10YR 3/2) silt loam, very dark gray (10YR 3/1) and grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

C1—31 to 43 inches; dark grayish brown (10YR 4/2) silt loam; few fine faint yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; few fine strong brown (7.5YR 5/6) concretions (iron oxide); neutral; gradual smooth boundary.

C2—43 to 60 inches; grayish brown (10YR 5/2) silt loam high in sand; common fine faint yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; neutral.

The solum and the mollic epipedon are 24 to 36 inches thick. Reaction ranges from slightly acid to mildly alkaline in the solum. The texture typically is silt loam, but the range includes silty clay loam. The control section on the average is 18 to 28 percent clay and less than 15 percent sand coarser than very fine.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y, value of 3 through 6, and chroma of 1 to 3.

Lindley Series

The Lindley series consists of well drained, moderately slowly permeable soils on convex side slopes on uplands. These soils formed in glacial till. The slope ranges from 14 to 30 percent.

Lindley soils are commonly adjacent to Arenzville, Chaseburg, Downs, Fayette, and Orion soils. Arenzville and Chaseburg soils formed in silty alluvium and are downslope from Lindley soils. Downs and Fayette soils formed in loess and are generally upslope. Orion soils are somewhat poorly drained; they formed in silty alluvium and are downslope in nearby drainageways.

Typical pedon of Lindley loam, 18 to 30 percent slopes, in a permanent pasture on an east-facing side slope on uplands; 320 feet west and 430 feet south of the northeast corner of sec. 6, T. 89 N., R. 1 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) and very pale brown (10YR 7/3) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; abrupt smooth boundary.

BE—7 to 11 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure parting to weak fine granular; friable; medium acid; clear smooth boundary.

Bt1—11 to 20 inches; yellowish brown (10YR 5/6) clay loam; weak fine subangular blocky and angular blocky structure; firm; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; few pebbles less than one-quarter inch in diameter; medium acid; clear smooth boundary.

Bt2—20 to 30 inches; yellowish brown (10YR 5/4) clay loam; moderate fine and medium subangular blocky and angular blocky structure; firm; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; few pebbles one-quarter inch in diameter; strongly acid; clear smooth boundary.

Bt3—30 to 46 inches; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) heavy loam; few fine faint strong brown (7.5YR 5/8) and few fine distinct pale brown (10YR 6/3) mottles; moderate fine and medium prismatic structure; firm; few discontinuous yellowish brown (10YR 5/4) clay films; strongly acid; clear smooth boundary.

C—46 to 60 inches; mottled pale brown (10YR 6/3), very pale brown (10YR 7/3), and yellowish brown (10YR 5/8) loam; massive; firm; few strong brown (7.5YR 5/6) iron segregations; medium acid.

The thickness of the solum ranges from 30 to 50 inches. Generally, there are no carbonates in the upper 60 inches.

The Ap horizon is very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or brown (10YR 4/3). In uncultivated areas, the E horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). The texture typically is loam, but the range includes silt loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 through 6. The lower part of the Bt, Bw, and BC horizons is mottled in some pedons. The Bt, Bw, and BC horizons are clay loam in the upper part and loam in the lower part; clay content on the average is 25 to 32 percent. The B horizon typically is medium acid or strongly acid.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 6 or 8 and is commonly mottled in hue of 10YR, 2.5Y, or 5Y, value of 5 to 7, and chroma of 2 or 3.

Marlean Series

The Marlean Series consists of excessively drained, moderately rapidly permeable soils on convex ridges and side slopes on uplands. These soils formed in 8 to 18 inches of loamy material over shattered cherty limestone. The native vegetation was grasses. The slope ranges from 5 to 14 percent.

Marlean soils are commonly adjacent to Dickinson, Ostrander, Rollingstone, and Sogn soils. Unlike Marlean soils, Dickinson soils are not underlain by limestone bedrock at a depth of 60 inches or more; they are in nearby positions surrounding the Marlean soils. Ostrander soils formed in friable and firm glacial till and are higher on the landscape than Marlean soils. Rollingstone soils formed in cherty clayey residuum more than 60 inches thick; they are upslope from Marlean soils. Sogn soils formed in 8 to 20 inches of loamy sediment over indurated level-bedded limestone. Sogn soils are downslope on the landscape.

Typical pedon of Marlean sandy loam, 5 to 14 percent slopes, in a hayfield on a northwest-facing convex side slope on uplands; 2,600 feet west and 380 feet north of the southeast corner of sec. 28, T. 88 N., R. 2 W.

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

A—8 to 14 inches; black (10YR 2/1) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; about 10 percent chert fragments that are 1/2 to 1 inch in diameter; neutral; abrupt wavy boundary.

2C—14 to 60 inches; dark grayish brown (10YR 4/2) extremely cobbly sandy loam interbedded between joints and surrounding limestone and chert fragments; massive; loose; 75 percent shattered chert and limestone fragments that are 1 inch to 6 inches in diameter; mildly alkaline.

The thickness of the solum typically is about 8 to 16 inches and decreases as the slope gradient increases. Reaction is neutral to moderately alkaline in the solum.

The Ap or A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The A horizon ranges in thickness from 8 to 16 inches. In some pedons there is a B horizon. The B horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4). The B horizon typically is cherty loam or cherty sandy loam, but the range includes cherty sandy clay loam. The 2C horizon typically has hue of 10YR, value of 4 or 5, and chroma of 2 through 6. The 2C horizon typically is cherty and cobbly and is loam, sandy loam, or loamy sand in the fine-earth fraction. The fragmented cherty limestone is 4 to 10 feet thick.

Marshan Series

The Marshan series consists of poorly drained, moderately permeable over rapidly permeable soils on outwash plains. These soils formed in 24 to 40 inches of loamy alluvium over sandy alluvium. The native vegetation was grasses. The slope ranges from 0 to 2 percent.

Marshan soils are similar to Clyde soils and are commonly adjacent to Clyde and Hayfield soils. Clyde soils formed in loamy alluvium over glacial till and are upslope from Marshan soils. Hayfield soils are somewhat poorly drained and are in slightly higher positions on the landscape.

Typical pedon of Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field on a concave southeast-facing outwash channel; 1,920 feet north and 810 feet west of the southeast corner of sec. 30, T. 88 N., R. 2 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A1—10 to 17 inches; black (N 2/0) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky and granular structure; friable; few fine brown (7.5YR 4/4) concretions (iron oxide); medium acid; clear smooth boundary.

A2—17 to 23 inches; black (10YR 2/1) clay loam, dark gray (N 4/0) dry; moderate medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bg1—23 to 30 inches; dark gray (5Y 4/1) clay loam; moderate fine subangular blocky structure; firm; few brown (7.5YR 4/4) concretions (iron oxide) along root channels; black (10YR 2/1) krotovina at 29 inches; slightly acid; clear smooth boundary.

Bg2—30 to 35 inches; gray (5Y 5/1) loam; few medium distinct light olive brown (2.5Y 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; slightly acid; abrupt wavy boundary.

2Cg1—35 to 39 inches; grayish brown (10YR 5/2) sandy loam; massive with some vertical cleavage; very friable; slightly acid; gradual smooth boundary.

2Cg2—39 to 60 inches; grayish brown (2.5Y 5/2) coarse sand; single grained; loose; 12 percent pebbles one-quarter to one-half inch in diameter; slightly acid.

The thickness of the solum and the depth to the 2C horizon typically are 32 to 40 inches, but the range begins at 24 inches. Depth to carbonates ranges from 38 to 75 inches. The mollic epipedon is 12 to 24 inches thick.

The A horizon is black (10YR 2/1 or N 2/0) or very dark gray (10YR 3/1) and typically is loam or clay loam, but the range includes silty clay loam. The B horizon has hue of 2.5Y or 5YR, value of 4 or 5, and chroma of 1 or 2. The lower part of the B horizon in places includes a sandy loam transitional layer less than 6 inches thick, or it is as much as 20 percent gravel. The B horizon is slightly acid or neutral. The 2C horizon is as much as 50 percent gravel, and the horizon is stratified.

Medary Series

The Medary series consists of well drained, slowly permeable soils on stream terrace escarpments along the Mississippi River and its tributaries. These soils formed in clayey and silty lacustrine sediment 28 to 40 inches thick. The native vegetation was trees. The slope ranges from 18 to 30 percent.

Medary soils are commonly adjacent to Caneek, Dorchester, and Zwingle soils. Caneek and Dorchester soils formed in recent silty alluvium on bottom lands. Zwingle soils are poorly drained, have a grayer B horizon than that of Medary soils, and are less sloping in positions above Medary soils.

Typical pedon of Medary silt loam, 18 to 30 percent slopes, in a permanent pasture on an east-facing terrace escarpment; 600 feet north and 1,770 feet east of the southwest corner of sec. 6, T. 88 N., R. 3 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam (26 percent clay), light brownish gray (10YR 6/2) dry; moderate fine subangular blocky and granular structure; friable; slightly acid; clear smooth boundary.

E—4 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam (37 percent clay), light gray (10YR 7/2) dry; moderate medium and thin platy structure; friable; medium acid; clear smooth boundary.

BE—7 to 10 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silty clay (42 percent clay); few

fine distinct brown (7.5YR 4/4) mottles; moderate medium and fine subangular blocky structure; friable; medium acid; clear smooth boundary.
Bt1t—10 to 17 inches; reddish brown (5YR 4/4) silty clay (53 percent clay); moderate medium angular blocky structure; firm; thin discontinuous brown (7.5YR 5/4) clay films; medium acid; gradual smooth boundary.
Bt2—17 to 25 inches; reddish brown (5YR 4/4) silty clay (57 percent clay); weak medium prismatic structure parting to moderate fine angular blocky; firm; thin discontinuous reddish brown clay films; slightly acid; clear smooth boundary.
BC—25 to 30 inches; reddish brown (5YR 4/4) silty clay (48 percent clay); weak fine prismatic structure; friable; few thin strata of reddish brown (5YR 5/3) silt loam; few fine lime concretions; neutral; clear smooth boundary.
C1—30 to 44 inches; stratified grayish brown (2.5Y 5/2) silt loam (22 percent clay); massive; friable; neutral; and reddish brown (5YR 4/4) silty clay (52 percent clay); massive; firm; strong effervescence; mildly alkaline; clear smooth boundary.
C2—44 to 60 inches; stratified reddish brown (5YR 4/4) silty clay loam (29 percent clay) and grayish brown (2.5Y 5/2) silt loam (18 percent clay); few fine distinct light olive brown (2.5Y 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 36 inches. There are no carbonates in the upper 24 inches.

The A horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2) and is 4 to 6 inches thick. It is silt loam or silty clay loam. The E horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or dark brown (7.5YR 4/2) and is less than 5 inches thick.

The BE horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 through 6. The Bt horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 through 6. The B horizon is silty clay loam, silty clay, or clay. The B horizon is slightly acid to strongly acid in the most acid part.

The C horizon has hue of 5YR, 2.5YR, or 2.5Y, value of 4 or 5, and chroma of 2 through 8. The C horizon is silt loam, silty clay loam, or silty clay.

Muscatine Series

The Muscatine series consists of somewhat poorly drained, moderately permeable soils on upland divides and on the lower part of foot slopes. These soils formed in 60 inches or more of loess. The native vegetation was grasses. The slope ranges from 1 to 3 percent.

Muscatine soils are similar to Atterberry soils and are commonly adjacent to Atterberry and Tama soils. Atterberry soils have a thinner A horizon than that of Muscatine soils and are downslope from Muscatine soils. Tama soils are well drained, have a browner B horizon, and are upslope.

Typical pedon of Muscatine silt loam, 1 to 3 percent slopes, in a cultivated field on a northeast-facing concave slope near the head of a drainageway on uplands; 950 feet east and 1,530 feet north of the southwest corner of sec. 6, T. 89 N., R. 2 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam (26 percent clay), dark grayish brown (10YR 4/2) dry; weak fine granular and subangular blocky structure; friable; neutral; abrupt smooth boundary.
A—8 to 18 inches; very dark brown (10YR 2/2) silty clay loam (30 percent clay), dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.
BA—18 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam (31 percent clay); weak fine subangular blocky structure; friable; dark brown (10YR 3/3) coatings on faces of peds; slightly acid; clear smooth boundary.
Bg1—22 to 31 inches; grayish brown (10YR 5/2) silty clay loam (29 percent clay); few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few thin discontinuous grayish brown (10YR 5/2) clay films; brown (10YR 5/3) coatings on faces of peds; medium acid; gradual smooth boundary.
Bg2—31 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam (28 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; few thin discontinuous grayish brown (10YR 5/2) clay films; few very dark gray (10YR 3/1) concretions (manganese oxide); medium acid; clear smooth boundary.
BCg—41 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam (27 percent clay); common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few discontinuous grayish brown (2.5Y 5/2) clay films; few very dark gray (10YR 3/1) concretions (manganese oxide); medium acid; clear smooth boundary.
Cg—48 to 60 inches; grayish brown (2.5Y 5/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few very dark gray (10YR 3/1) concretions (manganese oxide); medium acid.

The thickness of the solum ranges from 40 to more than 60 inches. The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) and is 14 to 20 inches thick. It is 25 to 30 percent clay. The B horizon has hue of 10YR and 2.5Y, value of 4 and 5, and chroma of 2 with mottles of higher chroma. The B horizon typically is silty clay loam; it is about 27 to 32 percent clay. The lower part of the B and C horizons is 5 to 15 percent sand in some pedons. The B horizon is medium acid to strongly acid.

Newvienna Series

The Newvienna series consists of moderately well drained, moderately permeable soils at the head of drainageways and on side slopes along drainageways on uplands. These soils formed in more than 60 inches of loess. The native vegetation was mixed grasses and trees. The slope ranges from 5 to 14 percent.

Newvienna soils are similar to Downs soils and are commonly adjacent to Downs, Orion, and Tama soils. Downs soils do not have mottles within a depth of 36 inches or more; they are upslope from Newvienna soils. Orion soils formed in alluvium, are somewhat poorly drained, and are along drainageways. Tama soils have a thicker A horizon than that of Newvienna soils and do not have mottles within a depth of 36 inches. Tama soils are on long side slopes above Newvienna soils.

Typical pedon of Newvienna silt loam, 5 to 9 percent slopes, moderately eroded, in a cultivated field on a west-facing convex upland side slope; 2,090 feet east and 110 feet north of the southwest corner of sec. 8, T. 89 N., R. 2 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam (25 percent clay), grayish brown (10YR 5/2) dry; pockets of brown (10YR 4/3) silty clay loam (subsoil material); weak fine granular and weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

Bt1—6 to 10 inches; brown (10YR 4/3) and dark brown (10YR 3/3) silty clay loam (30 percent clay); weak medium subangular blocky structure; friable; dark brown (10YR 3/3) coatings on faces of peds; slightly acid; clear smooth boundary.

Bt2—10 to 19 inches; brown (10YR 4/3 and 5/3) silty clay loam (30 percent clay); few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few thin discontinuous grayish brown (10YR 5/2) clay films; few very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) concretions (manganese oxide); medium acid; clear smooth boundary.

Bt3—19 to 26 inches; brown (10YR 5/3) silty clay loam (28 percent clay); common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few discontinuous grayish brown (10YR 5/2) clay films; medium acid; clear smooth boundary.

Bt4—26 to 37 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) silty clay loam (28 percent clay); weak fine and medium prismatic structure; friable; few discontinuous grayish brown (10YR 5/2) clay films; few black (10YR 2/1) concretions (manganese oxide); medium acid; clear smooth boundary.

C—37 to 60 inches; light brownish gray (2.5Y 6/2) silt loam (26 percent clay); common fine distinct strong brown (7.5YR 5/8) mottles; massive; friable; few grayish brown (10YR 5/2) clay flows along vertical cleavage faces; few fine strong brown (7.5YR 5/6) concretions (iron oxide); few fine black (10YR 2/1) concretions (manganese oxide); slightly acid.

The thickness of the solum ranges from 30 to 45 inches. There are no carbonates in the solum. Clay content ranges from 22 to 32 percent in the upper part of the solum and from 15 to 20 percent in the lower part of the solum and substratum. Sand content is less than 5 percent throughout the solum.

The Ap horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or dark grayish brown (10YR 4/2) and typically is 6 to 9 inches thick. There is a BE horizon in some pedons. The BE horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 through 6. The mottles have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 through 8. Typically, there are gray mottles at a depth of 20 to 30 inches, but in some pedons there are mottles at a depth of 10 inches. The B horizon ranges from slightly acid to strongly acid. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 through 8.

Nordness Series

The Nordness series consists of shallow, well drained, moderately permeable soils on upland ridges, side slopes, and escarpments. These soils formed in 8 to 20 inches of silty sediment and residuum over hard, fractured limestone bedrock. The native vegetation was trees. The slope ranges from 9 to 60 percent.

Nordness soils are similar to Sogn soils and are commonly adjacent to Dubuque, Fayette, Rollingstone, and Volney soils. Dubuque soils formed in 20 to 40 inches of loess and residuum over limestone and are upslope from Nordness soils. Fayette soils formed in more than 60 inches of loess and are upslope from Nordness and Dubuque soils but are also downslope on some landscapes. Rollingstone soils formed in loess and cherty clayey residuum and are upslope. Sogn soils formed in 8 to 20 inches of loamy material over hard, fractured limestone; they do not have an E horizon. Volney soils formed in channery loamy alluvium and are downslope.

Typical pedon of Nordness silt loam, 18 to 35 percent slopes, in a permanent pasture on a convex, southwest-facing side slope; 1,360 feet north and 1,990 feet west of the southeast corner of sec. 25, T. 87 N., R. 1 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry;

moderate fine granular structure; friable; slightly acid; clear smooth boundary.

E—4 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak thin platy structure; friable; slightly acid; abrupt smooth boundary.

2Bt—9 to 13 inches; brown (7.5YR 4/4) silty clay loam (38 percent clay); moderate fine and medium subangular blocky structure; friable; few thin discontinuous dark brown (7.5YR 3/4) clay films; neutral; abrupt smooth boundary.

2R—13 inches; level-bedded indurated limestone with residuum in fractures.

The thickness of the solum and the depth to limestone range from 8 to 20 inches. The solum is free of primary carbonates. It ranges from neutral to medium acid.

The A horizon is 1 to 4 inches thick and has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The A horizon is silt loam, or, less commonly, loam with a high silt content. In some pedons there is an Ap horizon. The Ap horizon is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2).

The B horizon has hue of 10YR in the upper part and hue of 7.5YR or 5YR in the lower part. The 2Bt horizon is silty clay loam, silty clay, or clay and is 1 to 5 inches thick.

Olin Series

The Olin series consists of well drained, moderately permeable soils on ridgetops and side slopes on uplands. These soils formed in 20 to 36 inches of loamy eolian sediment over glacial till. The native vegetation was grasses. The slope ranges from 2 to 9 percent.

Olin soils are similar to Dickinson and Kenyon soils and are commonly adjacent to Dickinson, Lamont, Ostrander, and Terril soils. Dickinson soils are somewhat excessively drained. Dickinson and Lamont soils formed in more than 40 inches of eolian sediment and are higher on the landscape than Olin soils. Kenyon and Ostrander soils formed in loamy sediment over glacial till. Terril soils formed in loamy alluvium and are downslope along drainageways.

Typical pedon of Olin fine sandy loam, 5 to 9 percent slopes, in a cultivated field on an east-facing convex upland side slope; 95 feet south and 65 feet east of the center of sec. 34, T. 88 N., R. 2 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; friable; neutral; abrupt smooth boundary.

A1—7 to 14 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

A2—14 to 20 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw1—20 to 29 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; very friable; 5 to 10 percent 1/4- to 1-inch chert fragments; neutral; clear smooth boundary.

Bw2—29 to 34 inches; yellowish brown (10YR 5/4) loamy sand; very weak fine and medium subangular blocky structure; very friable; slightly acid; clear wavy boundary.

2Bw3—34 to 42 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; few yellowish brown (10YR 5/6) coatings on faces of peds; 10 to 15 percent 1/2- to 1-inch chert and gravel fragments; medium acid; gradual smooth boundary.

2Bw4—42 to 51 inches; yellowish brown (10YR 5/4) loam; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; few yellowish red (5YR 5/6) iron stains and few fine black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.

2BC—51 to 60 inches; yellowish brown (10YR 5/6 and 5/8) loam; weak coarse prismatic structure; firm; few light yellowish brown (10YR 6/4) coatings on faces of peds; medium acid.

The solum is 40 to 60 inches thick. The depth to carbonates ranges from 50 to 80 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is fine sandy loam or sandy loam and is 14 to 24 inches thick. The Bw horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. Its texture centers on sandy loam. The 2Bw horizon is loam, clay loam, or sandy clay loam and commonly has a stone line at the upper boundary. Colors of the 2Bw horizon are similar to those of the Bw horizon, but chroma ranges to 6. In the 2B horizon, there are mottles of low chroma in some pedons below a depth of 30 inches. The B horizon is medium acid or strongly acid in the most acid part. The 2C horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 4 through 8.

Orion Series

The Orion series consists of somewhat poorly drained, moderately permeable soils on narrow bottom lands. These soils formed in 20 to 40 inches of recent, stratified silty alluvium over an older buried soil. The native vegetation was trees. The slope ranges from 1 to 4 percent.

Orion soils are commonly adjacent to Arenzville, Exette, Lindley, and Newvienna soils. Arenzville soils are moderately well drained and are downstream from Orion soils. Exette soils are well drained and are upslope on the surrounding side slopes on uplands. Lindley soils formed in glacial till and are on the lower part of side slopes. Newvienna soils are moderately well drained, formed in loess, and are on upland side slopes above the Orion soils.

Typical pedon of Orion silt loam, 1 to 4 percent slopes, in a cultivated field on a southwest-facing upland drainageway; 1,760 feet north and 2,280 feet west of the southeast corner of sec. 16, T. 88 N., R. 2 W.

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

C1—5 to 15 inches; stratified dark grayish brown (10YR 4/2) and brown (10YR 5/3) silt loam; appears massive but parts to weak medium platy fragments; friable; few dark gray (10YR 4/1) lamellae; few fine very dark gray (10YR 3/1) and brown (7.5YR 4/2) concretions (iron and manganese oxide); slightly acid; clear smooth boundary.

C2—15 to 28 inches; stratified 80 percent dark grayish brown (10YR 4/2) and 20 percent grayish brown (10YR 5/2) silt loam; few fine distinct brown (7.5YR 5/4) and strong brown (7.5YR 5/6) and common fine faint dark gray (2.5YR 4/1) mottles; appears massive but parts to weak medium and thick platy fragments; friable; few fine dark reddish brown (5YR 3/3) concretions (manganese oxide); slightly acid; gradual smooth boundary.

Ab1—28 to 42 inches; black (10YR 2/1) mucky silt loam (25 percent clay); weak medium and fine subangular blocky structure; friable; few very fine brown (7.5YR 4/4) and strong brown (7.5YR 5/6) concretions (iron oxide); sapric material with grayish brown (2.5Y 5/2) coatings at 38 to 40 inches; neutral; gradual smooth boundary.

Ab2—42 to 50 inches; black (N 2/0) silty clay loam (27 percent clay); weak coarse and medium subangular blocky structure; friable; neutral; clear smooth boundary.

Ab3—50 to 60 inches; black (10YR 2/1) silty clay loam (27 percent clay); weak medium subangular blocky structure; friable; neutral.

Depth to the buried horizon (Ab) ranges from 20 to 40 inches. The control section on the average is 10 to 18 percent clay. Reaction in the solum is neutral, but it ranges from mildly alkaline to medium acid.

The Ap horizon and the C1 horizon have hue of 10YR, value of 4 or 5, and chroma of 2 or 3. These horizons are stratified. There are thin strata of very fine sand in the C1 horizon in some pedons. The C2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The C2 horizon commonly has mottles of both high and low chroma. The Ab horizon is silt loam or silty clay loam. Organic matter content commonly is about 10 to 15 percent in the upper part of the Ab horizon. In some pedons there is a C horizon below the Ab horizon.

Orwood Series

The Orwood series consists of well drained, moderately permeable soils on ridges and side slopes on uplands. These soils formed in loamy and silty eolian sediment more than 60 inches thick. The native vegetation was mixed grasses and trees. The slope ranges from 5 to 25 percent.

Orwood soils are similar to Downs soils and are commonly adjacent to Dickinson, Downs, and Schley soils. Dickinson soils formed in coarser sediment than Orwood soils and have a thicker mollic epipedon. They and Orwood soils are on the same landscape. Downs soils formed in loess and are upslope. Schley soils are somewhat poorly drained. They formed in stratified glacial sediment and underlying glacial till at the head of drainageways and on toe slopes.

Typical pedon of Orwood silt loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field on a convex upland side slope; 2,430 feet west and 760 feet north of the southeast corner of sec. 28, T. 87 N., R. 1 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; mixed with some streaks and pockets of brown (10YR 4/3) silt loam subsoil material; weak fine granular structure; friable; neutral; abrupt smooth boundary.

BE—7 to 13 inches; brown (10YR 4/3) silt loam (about 26 percent sand); weak medium and fine subangular blocky structure; friable; very dark grayish brown (10YR 3/2) coatings on faces of peds; few black (10YR 2/1) root channels; neutral; clear smooth boundary.

Bt1—13 to 24 inches; dark yellowish brown (10YR 4/4) silt loam (about 30 percent sand); moderate medium and fine subangular blocky structure; friable; few thin discontinuous brown (7.5YR 4/4) clay films; brown (10YR 4/3) coatings on faces of peds; light gray (10YR 7/2) (dry) silt coatings on peds; slightly acid; gradual smooth boundary.

Bt2—24 to 30 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few thin discontinuous brown (7.5YR 4/4) clay films; brown (10YR 4/3) coatings on faces of peds; light gray (10YR 7/2) (dry) silt coatings on peds; few fine black (10YR 2/1) concretions (manganese oxide); medium acid; gradual smooth boundary.

Bt3—30 to 39 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few thin discontinuous brown (7.5YR 4/4) clay films; light gray (10YR 7/2) (dry) silt coatings on faces of peds; few fine strong brown

(7.5YR 5/8) iron accumulations (oxide); few fine black (10YR 2/1) concretions (manganese oxide); 1/2-inch sandy loam lens at 38 inches; medium acid; clear smooth boundary.

BC—39 to 46 inches; yellowish brown (10YR 5/4) silt loam (about 30 percent sand); moderate coarse subangular blocky structure; friable; light gray (10YR 7/2) (dry) silt coatings on peds; few fine yellowish red (5YR 4/6) concretions (iron oxide); 1-inch loamy sand lens at 45 inches; medium acid; gradual smooth boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few fine faint grayish brown (10YR 5/2) and brownish yellow (10YR 6/6) mottles; 1/2-inch loamy sand lens at 55 inches, 1 1/2-inch lens at 57 inches; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. There are no carbonates in the upper 60 inches.

The Ap horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3) and is 5 to 9 inches thick. In some pedons the A horizon is very dark gray (10YR 3/1). In some pedons there is an E horizon that is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The B horizon is silt loam high in sand, loam, or clay loam with clay content between 24 and 30 percent and content of fine sand and coarser material between 15 and 40 percent. The Bt horizon is free of low=chroma mottles, but the BC and C horizons have fine faint mottles in some pedons. The B horizon ranges from slightly acid to strongly acid in the most acid part.

Ostrander Series

The Ostrander series consists of well drained, moderately permeable soils on ridges and side slopes on uplands. These soils formed in 12 to 28 inches of loamy sediment and in the underlying glacial till. The native vegetation was grasses. The slope ranges from 2 to 9 percent.

Ostrander soils are similar to Racine soils and are commonly adjacent to Burkhardt, Dickinson, Floyd, Kenyon, Olin, and Terril soils. Burkhardt soils formed in loamy material underlain by sand and gravel on outwash plains. Dickinson soils formed in more than 40 inches of loamy eolian sediment. Floyd soils have thicker loamy sediment, are somewhat poorly drained, and are along drainageways. Kenyon soils are moderately well drained and are upslope on the landscape. Olin soils formed in 20 to 36 inches of loamy eolian sediment underlain by glacial till and are upslope. Racine soils have an E horizon. Terril soils formed in loamy alluvium and are downslope along drainageways.

Typical pedon of Ostrander loam, 2 to 5 percent slopes, in a cultivated field on a lower south-facing convex side slope on uplands; 1,200 feet east and 70 feet south of the northwest corner of sec. 7, T. 88 N., R. 1 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—9 to 18 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

BA—18 to 24 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; very dark grayish brown (10YR 3/2) coatings on faces of peds; medium acid; clear smooth boundary.

Bw1—24 to 34 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; less than 5 percent fine gravel pebbles in the lower part; strongly acid; clear wavy boundary.

2Bw2—34 to 43 inches; dark yellowish brown (10YR 4/4) loam with sandy clay loam strata; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; about 7 percent fine gravel pebbles in the upper part; strongly acid; clear wavy boundary.

2Bw3—43 to 51 inches; yellowish brown (10YR 5/6) loam with fine sandy loam strata; weak medium subangular blocky structure; friable; about 7 percent fine gravel pebbles in the lower part; strongly acid; clear wavy boundary.

2Bw4—51 to 60 inches; dark yellowish brown (10YR 4/4) loam (26 percent clay); few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; firm; about 5 percent medium gravel pebbles in the upper part; medium acid.

The thickness of the solum is 45 to 70 inches. There are no carbonates in the upper 60 inches. The depth to firm glacial till is 30 to 55 inches.

The Ap or A horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) and is 10 to 20 inches thick. The A horizon typically is loam but ranges to include silt loam high in sand. The 2B horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. The 2B horizon is loam, sandy loam, or sandy clay loam and 5 to 10 percent fine gravel; most pedons are stratified. The 2B horizon is medium acid or strongly acid.

Otter Series

The Otter series consists of poorly drained, moderately permeable soils on bottom lands and low alluvial terraces. These soils formed in silty alluvium more than 60 inches thick. The native vegetation was grasses. The slope ranges from 0 to 2 percent.

Otter soils are similar to Lawson soils and are commonly adjacent to Arenzville, Chaseburg, Huntsville, Lawson, and Worthen soils. Arenzville and Chaseburg soils are moderately well drained; they formed in lighter colored, recently stratified alluvium in slightly lower positions on the landscape than Otter soils. Huntsville soils are moderately well drained and are on second bottoms. Lawson soils are somewhat poorly drained and are slightly higher on the landscape. Worthen soils are well drained and are on foot slopes above Otter soils.

Typical pedon of Otter silt loam, overwash, 0 to 2 percent slopes, in a cultivated field on a flood plain; 325 feet west and 1,770 feet south of the northeast corner of sec. 28, T. 88 N., R. 1 W.

Ap—0 to 8 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, grayish brown (10YR 5/2) and light gray (10YR 7/2) dry; weak medium platy structure (the result of stratification); friable; few very dark gray (10YR 3/1) coatings on faces of peds; neutral; abrupt smooth boundary.

A1—8 to 18 inches; black (N 2/0) silt loam, dark gray (N 4/0) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A2—18 to 26 inches; very dark gray (N 3/0) silt loam (25 percent clay), dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; gradual smooth boundary.

A3—26 to 34 inches; very dark gray (N 3/0) silt loam (26 percent clay), dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

C1—34 to 46 inches; dark gray (10YR 4/1) silt loam (25 percent clay); moderate fine prismatic structure; friable; few fine dark red (2.5YR 3/6) concretions (iron oxide); neutral; gradual smooth boundary.

C2—46 to 60 inches; dark gray (10YR 4/1) silt loam; weak medium subangular blocky structure; friable; few fine dark red (2.5YR 3/6) concretions (iron oxide); neutral.

The solum and the A horizon are 24 to 40 inches thick. The solum is neutral or slightly acid. There are no carbonates in the upper 40 inches.

The Ap horizon is light colored overwash that is 6 to 20 inches thick. The A horizon is black (N 2/0 or 10YR 2/1) or very dark gray (N 3/0 or 10YR 3/1). It typically is silt loam, but in some pedons there are thin strata of silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. The C horizon is silt loam, but in some pedons there are strata of silty clay loam or sandy loam.

Racine Series

The Racine series consists of well drained, moderately permeable soils on ridges and side slopes on uplands. These soils formed in 12 to 24 inches of loamy sediment and in the underlying glacial till. The native vegetation was mixed grasses and trees. The slope ranges from 2 to 25 percent.

Racine soils are similar to Ostrander soils and are commonly adjacent to Bassett, Schley, and Winneshiek soils. Bassett soils are moderately well drained and are upslope on the landscape. Ostrander soils do not have an E horizon. Schley soils have thicker loamy sediment than that of Racine soils and are somewhat poorly drained. They are at the head of drainageways and on foot slopes at the lower elevations. Winneshiek soils formed in 20 to 40 inches of loamy sediment over limestone and are downslope on the lower part of side slopes.

Typical pedon of Racine loam, 5 to 9 percent slopes, in a hayfield on a west-facing upland side slope; 1,995 feet north and 495 feet east of the southwest corner of sec. 20, T. 88 N., R. 2 W.

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

E—8 to 12 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak medium platy structure parting to moderate fine subangular blocky; friable; slightly acid; clear smooth boundary.

BE—12 to 18 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) loam, dark yellowish brown (10YR 4/4) rubbed; moderate fine angular blocky and subangular blocky structure; friable; slightly acid; clear smooth boundary.

2Bt1—18 to 27 inches; dark yellowish brown (10YR 4/4) sandy clay loam; weak medium and fine subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films; medium acid; gradual smooth boundary.

2Bt2—27 to 39 inches; dark yellowish brown (10YR 4/4) sandy clay loam; weak medium and fine subangular blocky structure; friable; thin discontinuous brown (7.5YR 4/4) clay films; medium acid; clear smooth boundary.

3BC—39 to 50 inches; yellowish brown (10YR 5/6) loam; weak medium prismatic structure; firm; few thin continuous brown (10YR 4/3) clay films in root channels; few 1/4- to 1/2-inch pebbles; medium acid; clear smooth boundary.

3C1—50 to 58 inches; yellowish brown (10YR 5/6) loam; massive with some vertical cleavage;; firm; sandy loam lens at 57 to 58 inches; few 1/4- to 1/2-inch pebbles; medium acid; clear smooth boundary.

3C2—58 to 60 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (2.5Y 6/2) and few fine faint strong brown (7.5YR 5/6) mottles; massive; firm; few 1/4- to 1/2-inch pebbles; few fine strong brown (7.5YR 5/6) concretions (iron oxide); medium acid.

The solum is 36 to 60 inches thick. The depth to firm glacial till is 30 to 50 inches, and the depth to free carbonates is 40 to more than 60 inches.

The Ap or A horizon is very dark grayish brown (10YR 3/2), except where the E horizon has been mixed into the Ap horizon; there it is dark grayish brown (10YR 4/2). The Ap or A horizon is 5 to 8 inches thick. The E horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 5/3) and is 4 or 5 inches thick. The A and E horizons are silt loam high in sand or loam. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 through 6. In some pedons, there are sand and silt coatings on faces of peds in the 2Bt horizon. The 3C horizon typically is yellowish brown (10YR 5/6) and has mottles in hue of 2.5YR or 7.5YR, value of 5 or 6, and chroma of 2 through 6 in the lower part. The 2Bt horizon is medium acid or strongly acid.

Rockton Series

The Rockton series consists of moderately deep, well drained, moderately permeable soils on upland ridges and side slopes. These soils formed in 20 to 40 inches of loamy glacial drift and thin residuum over limestone. The native vegetation was grasses. The slope ranges from 2 to 9 percent.

Rockton soils are similar to Winneshiek soils and are commonly adjacent to Floyd, Kenyon, and Sogn soils. Floyd soils are somewhat poorly drained and formed in stratified glacial sediment and underlying glacial till and are on toe slopes and at the head of drainageways. Kenyon soils formed in loamy sediment and underlying glacial till and are on convex ridges and side slopes above Rockton soils. Sogn soils are somewhat excessively drained, formed in 8 to 20 inches of loamy sediment over limestone, and are on the lower part of side slopes. Winneshiek soils have a lighter colored A horizon and an E horizon.

Typical pedon of Rockton loam, 2 to 5 percent slopes, in a cultivated field on a convex upland side slope; 1,800 feet west and 1,970 feet north of the southeast corner of sec. 33, T. 87 N., R. 1 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, very dark grayish brown (10YR 3/2) rubbed, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—7 to 13 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium and fine subangular blocky structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

AB—13 to 19 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium and fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bt1—19 to 25 inches; dark yellowish brown (10YR 4/4) loam; moderate medium and fine subangular blocky structure; friable; few thin discontinuous very dark grayish brown (10YR 3/2) clay films; few fine pebbles; slightly acid; abrupt smooth boundary.

2Bt2—25 to 29 inches; brown (7.5YR 4/4) and yellowish brown (10YR 5/6) clay loam; few faint distinct yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; firm; few thin discontinuous very dark grayish brown (10YR 3/2) clay films; few 1/2- to 1-inch chert fragments; slightly acid; abrupt wavy boundary.

2R—29 inches; hard fractured limestone.

The thickness of the solum and the depth to limestone are 20 to 40 inches. There are no carbonates above the limestone.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon typically is loam, but the range includes silt loam high in sand. The A horizon is 10 to 20 inches thick. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon is loam or clay loam; the clay content ranges from 25 to 35 percent. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 6. The 2Bt horizon is 1 inch to 5 inches thick, but in some pedons it may be evident only as thin rinds around limestone flags. The 2Bt horizon is clay loam, clay, or silty clay. It is slightly acid or medium acid.

Rollingstone Series

The Rollingstone series consists of well drained, slowly permeable soils on upland ridgetops and side slopes. These soils formed in 5 to 15 inches of loess or silty sediment and in the underlying cherty clay limestone residuum. The native vegetaion was trees. The slope ranges from 5 to 14 percent.

Rollingstone soils are commonly adjacent to Dubuque, Fayette, Marlean, and Nordness soils. Dubuque soils formed in 20 to 40 inches of loess over thin residuum over limestone, and they are intermittent on adjacent side slopes near the upper part of drainage systems. Fayette soils formed in more than 60 inches of loess and have less clay in the B horizon. They are on ridges and side slopes above Rollingstone soils. Marlean soils formed in loamy eolian material over cherty limestone. Nordness soils are underlain by limestone at a depth of 8 to 20 inches and are on the lower part of side slopes and escarpments.

Typical pedon of Rollingstone silt loam, 5 to 9 percent slopes, moderately eroded, in a permanent pasture on a convex east-facing ridgetop; 1,170 feet west and 1,750 feet north of the center of sec. 27, T. 88 N., R. 3 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam (24 percent clay) grayish brown (10YR 5/2) dry; some pockets of brown (7.5YR 4/4) silty clay loam subsoil material; weak fine subangular blocky structure; friable; 10 percent 1/2- to 1-inch chert fragments; slightly acid; abrupt smooth boundary.

Bt—6 to 12 inches; brown (7.5YR 4/4) silty clay loam (35 percent clay); weak fine angular blocky structure; friable; few dark grayish brown (10YR 4/2) coatings on faces of peds; few discontinuous silt coatings on peds; about 1 percent 1-inch chert fragments; medium acid; gradual smooth boundary.

2Bt2—12 to 28 inches; red (2.5YR 4/6) cherty clay (82 percent clay); moderate fine angular blocky structure; firm; thin discontinuous yellowish red (5YR 5/6) clay films; about 23 percent 1-inch chert fragments; strongly acid; gradual smooth boundary.

2Bt3—28 to 36 inches; red (2.5YR 4/6) cherty clay (86 percent clay); moderate medium and fine angular blocky structure; very firm; thin discontinuous yellowish red (5YR 5/6) clay films; about 27 percent 1-inch chert fragments; common black (N 2/0) charcoal flakes; strongly acid; gradual smooth boundary.

2Bt4—36 to 48 inches; red (2.5YR 4/6) cherty clay (71 percent clay); moderate medium and fine angular blocky structure; very firm; thin discontinuous yellowish red (5YR 5/6) clay films; about 35 percent 1- to 3-inch chert fragments; few very dark gray (N 3/0) charcoal flakes; strongly acid; gradual smooth boundary.

2BC—48 to 60 inches; dark reddish brown (2.5YR 3/4) and red (2.5YR 4/8) very cherty clay (70 percent clay); weak fine subangular blocky and prismatic structure; firm; about 50 percent 3- to 4-inch chert fragments; few very dark gray (N 3/0) charcoal flakes; strongly acid; gradual wavy boundary.

The thickness of the solum ranges from 5 to 12 feet. There are no carbonates in the upper 60 inches.

The A or Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) and is 6 to 8 inches thick. In some pedons, there is an E horizon that is dark grayish brown (10YR 4/2) or brown (10YR 4/3) and is 3 to 5 inches thick. The content of chert fragments ranges, by volume, from 5 to 20 percent. The upper part of the B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4. The 2Bt and 2BC horizons have hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 4 through 8. The 2Bt horizon ranges from slightly acid to strongly acid.

Rozetta Series

The Rozetta series consists of moderately well drained, moderately permeable soils on loess-covered uplands. These soils formed in 5 to 10 feet of looess over shale. The native vegetation was trees. The slope ranges from 9 to 18 percent.

Rozetta soils are similar to Eleroy soils and are commonly adjacent to Eleroy, Fayette, Nordness, and Schapville soils. Eleroy soils are underlain by shale at a depth of 30 to 55 inches and are downslope from Rozetta soils. Fayette soils are well drained and are upslope on the less sloping ridges. Nordness soils are underlain by limestone at a depth of 8 to 20 inches and are upslope on escarpments. Schapville soils have a darker colored A horizon, formed in 15 to 30 inches of silty material or loess over shale, and are on steeper side slopes and along concave drainageways.

Typical pedon of Rozetta silt loam, in an area of Rozetta-Eleroy silt loams, 9 to 14 percent slopes, moderately eroded, in a cultivated field on a southeast-facing convex side slope in the uplands; 220 feet east and 1,300 feet south of the northwest corner of sec. 8, T. 90 N., R. 1 E.

Ap—0 to 7 inches; brown (10YR 4/3) and dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) dry; 10 to 20 percent pockets of dark yellowish brown (10YR 4/4) silty clay loam subsoil material; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

Bt1—7 to 14 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam (28 percent clay), pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) dry; moderate fine angular blocky and subangular blocky structure; friable; neutral; clear smooth boundary.

Bt2—14 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam (32 percent clay); weak fine angular blocky structure; friable; few thin discontinuous clay films; neutral; clear smooth boundary.

Bt3—21 to 26 inches; yellowish brown (10YR 5/4) silty clay loamn (32 percent clay); common fine distinct grayish brown (2.5Y 5/2) mottles; moderate fine angular blocky structure; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; neutral; clear smooth boundary.

Bt4—26 to 33 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silty clay loam (34 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; slightly acid; clear smooth boundary.

BC—33 to 43 inches; grayish brown (10YR 5/2) silty clay loam (31 percent clay); few fine distinct yellowish brown (10YR 5/6) mottles; weak medium and coarse prismatic structure; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; few fine strong brown (7.5YR 5/8) concretions (iron oxide); slightly acid; gradual smooth boundary.

C1—43 to 72 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few thin brown (7.5YR 4/4) and strong brown (7.5YR 5/8) iron bands; neutral; clear smooth boundary.

C2—72 to 79 inches; light brownish gray (10YR 6/2) and brownish yellow (10YR 6/8) silt loam; massive; friable; few thin brown (7.5YR 4/4) iron bands; few 1/2-inch chert fragments; moderate effervescence; mildly alkaline; gradual smooth boundary.

The thickness of the solum ranges from 30 to 45 inches. There are no carbonates in the solum.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3 and is 3 to 5 inches thick. It is mixed into the Ap horizon in most cultivated areas. In some pedons there is no E horizon. The Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 3 through 6. Mottles are common at a depth of 24 to 30 inches and at lesser depths as the slope, or gradient, increases. Mottles have hue of 10YR, value of 5 or 6, and chroma of 2 through 8. The Bt horizon typically is silty clay loam; the clay content ranges from 27 to 34 percent. The BC and C horizons have hue of 10YR, value of 5 or 6, and chroma of 2 through 8. Mottles typically are present in the BC horizon and the upper part of the C horizon. Iron oxide and bands are present throughout the C horizon in most pedons.

Schapville Series

The Schapville series consists of moderately deep, moderately well drained soils on upland side slopes. Permeability is moderate in the solum and very slow in the substratum. These soils formed in 15 to 30 inches of loess or silty material and in residuum weathered from shale. The native vegetation was grasses. The slope ranges from 9 to 30 percent.

Schapville soils are commonly adjacent to Arenzville, Chaseburg, Eleroy, and Rozetta soils. Arenzville and Chaseburg soils formed in stratified silty alluvium and are along drainageways and on bottom lands downslope. Eleroy soils are moderately well drained, formed in 30 to 55 inches of loess and underlying shale, and have a lighter colored A horizon that that of the Schapville soils. Eleroy soils are upslope on the same landscape. Rozetta soils formed in more that 60 inches of loess and underlying shale and are higher on the landscape.

Typical pedon of Schapville silt loam, 9 to 18 percent slopes, in a permanent pasture on a concave upland side slope; 2,500 feet east and 2,360 feet south of the northwest corner of sec. 6, T. 88 N., R. 2 E.

A1—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 14 inches; black (10YR 2/1) silt loam (26 percent clay), gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

Bt1—14 to 19 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine distinct olive brown (2.5Y 4/4) mottles; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

2Bt2—19 to 23 inches; light olive brown (2.5Y 5/4) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium angular blocky struction; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films; slight effervescence; mildly alkaline; clear smooth boundary.

2Cr—23 inches; mottled light yellowish brown (2.5Y 6/4) and light gray (5Y 6/1) clayey calcareous shale.

The solum is 20 to 35 inches thick. The depth to shale bedrock is 20 to 30 inches. Carbonates are commonly present in the lower part of the 2B or 2Cr horizons at a depth of 15 to 30 inches.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2). In some eroded areas, the Ap horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very grayish brown (10YR 3/2). The thickness is 7 to 18 inches. The 2Bt horizon has hue of 2.5Y or 5Y, value of 4, 5, or 6; and chroma of 2, 3, or 4 and is silty clay loam or silty clay. Reaction is neutral or mildly alkaline in the B horizon. The 2Cr horizon has hue of 2.5Y or 5Y, value of 6 or 7, and chroma of 1 through 4.

Map unit 712F is a taxadjunct to the Schapville series because the depth to shale bedrock is less than 20 inches. This difference, however, does not affect the use or behavior of the soil.

Schley Series

The Schley series consists of somewhat poorly drained, moderately permeable soils at the head of drainageways or on toe slopes along the drainageways on uplands. These soils formed in 32 to 48 inches of stratified loamy sediment and in the underlying glacial till. The native vegetation was mixed grasses and trees. The slope ranges from 1 to 4 percent.

Schley soils are similar to Floyd soils and are commonly adjacent to Bassett, Clyde, Floyd, Orwood, and Racine soils. The moderately well drained Bassett soils and the well drained Racine soils are upslope on convex ridgetops and side slopes. The poorly drained

Clyde soils have a mollic epipedon and are downslope on the landscape. The Floyd soils do not have an E horizon and are on the lower part of toe slopes along drainageways. Orwood soils are well drained, formed in 60 inches or more of loamy eolian sediment, and are on the surrounding landscape upslope or at higher elevations.

Typical pedon of Schley loam, 1 to 4 percent slopes, on a southwest-facing concave foot slope in a cultivated field; 2,210 feet south and 275 feet west of the northeast corner of sec. 33, T. 88 N., R. 2 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; mixed with some streaks and pockets of very dark grayish brown (10YR 3/2) subsurface material; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—7 to 11 inches; brown (10YR 5/3) loam, pale brown (10YR 6/3) dry; few fine faint dark yellowish brown (10YR 4/6) mottles; weak medium platy structure; friable; strongly acid; clear smooth boundary.

E2—11 to 15 inches; brown (10YR 5/3) loam, pale brown (10YR 6/3) dry; common fine faint yellowish brown (10YR 5/6) mottles; weak medium platy structure; friable; discontinuous yellowish brown (10YR 5/4) coatings on faces of peds; medium acid; clear smooth boundary.

BE—15 to 20 inches; brown (10YR 5/3) loam; common fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; few one-quarter to one-half inch chert fragments; strongly acid; clear smooth boundary.

Bt1—20 to 36 inches; mottles grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6 and 5/8) loam; weak medium and fine angular blocky structure; friable; sandy loam band at 20 to 25 inches; few thin discontinuous light brownish gray (2.5Y 6/2) clay films; few fine black (10YR 2/1) concretions (manganese oxide); strongly acid; clear smooth boundary.

2Bt2—36 to 44 inches; yellowish brown (10YR 5/6) loam; weak medium prismatic structure; firm; few thin discontinuous brown (10YR 5/3) clay films; few gray (10YR 5/1) clay flows in root channels; continuous light brownish gray (2.5Y 6/2) coatings on faces of peds; few medium dark oxides; medium acid; clear smooth boundary.

2C1—44 to 56 inches; yellowish brown (10YR 5/6) loam (26 percent clay); common medium distinct grayish brown (2.5Y 5/2) mottles; massive; firm; strong brown (7.5YR 5/6) iron band at 54 to 56 inches; few dark organic stains; neutral; clear smooth boundary.

2C2—56 to 60 inches; yellowish brown (10YR 5/6) loam (26 percent clay); common medium distinct grayish brown (2.5Y 5/2) mottles; massive; friable; neutral.

The thickness of the solum is commonly 40 to 50 inches but ranges to 66 inches in some pedons. The depth to carbonates typically is more than 60 inches but corresponds to the thickness of the solum in places. Reaction in the solum is strongly acid or very strongly acid in the most acid part of the E horizon.

The Ap or A horizon typically is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The E horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) or is brown (10YR 5/3) and has mottles. The upper part of the B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 through 8. Texture is loam, silt loam high in sand, or silty clay loam high in sand. Clay content ranges from 16 to 28 percent but on the average is more than 18 percent. The 2B and 2C horizons are strong brown (7.5YR 5/6 and 5/8) or yellowish brown (10YR 5/6 and 5/8) and grayish brown (2.5Y 5/2). Their texture is loam or sandy clay loam. Pebble bands are common at the upper boundary of the 2B material.

Seaton Series

The Seaton series consists of well drained, moderately permeable soils on upland ridges and side slopes. These soils formed in loess more than 60 inches thick. The native vegetation was trees. The slope ranges from 9 to 25 percent.

Seaton soils are similar to Fayette soils and are commonly adjacent to Fayette and Nordness soils. Fayette soils formed in loess higher in clay content, have a silty clay loam B horizon, and are generally upslope from Seaton soils. Nordness soils have limestone at a depth of 8 to 20 inches and are on side slopes and escarpments lower on the landscape than the Seaton soils.

Typical pedon of Seaton silt loam, 18 to 25 percent slopes, on a convex upland side slope, within the park near the Julien Dubuque Monument; 420 feet west and 260 feet south of the northeast corner of sec. 6, T. 88 N., R. 3 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) and very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) rubbed, grayish brown (10YR 5/2) and gray (10YR 5/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

E—3 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak thin platy structure; friable; slightly acid; clear smooth boundary.

BE—9 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and fine angular blocky and subangular blocky structure; friable; few discontinuous brown (10YR 4/3) coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—15 to 22 inches; brown (7.5YR 4/4) silt loam; moderate medium angular blocky structure; friable;

few thin discontinuous brown (10YR 4/3) clay films; medium acid; gradual smooth boundary.

Bt2—22 to 31 inches; yellowish brown (10YR 5/4) silt loam; moderate medium angular blocky structure; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; strongly acid; gradual smooth boundary.

Bt3—31 to 38 inches; yellowish brown (10YR 5/4) silt loam; moderate medium angular blocky structure; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; strongly acid; clear smooth boundary.

Bt4—38 to 45 inches; yellowish brown (10YR 5/4) silt loam; weak medium prismatic structure parting to moderate medium angular blocky; friable; few thin discontinuous dark yellowish brown (10YR 4/4) clay films; medium acid; gradual smooth boundary.

BC—45 to 60 inches; yellowish brown (1YR 5/4) silt loam; weak medium prismatic structure; friable; medium acid.

The solum typically is 4 to 6 feet thick, but in some pedons it is only 3 feet thick. There are no carbonates in the upper 60 inches.

The A or Ap horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2) and is 3 to 5 inches thick. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon on the average is 18 to 25 percent clay.

Sogn Series

The Sogn series consists of shallow, somewhat excessively drained, moderately permeable soils on ridges and side slopes on uplands. These soils formed in 8 to 20 inches of loamy residuum over hard limestone. The native vegetation was grasses. The slope ranges from 2 to 18 percent.

Sogn soils are similar to Nordness soils and are commonly adjacent to Backbone, Marlean, Rockton, Terril, and Winneshiek soils. Backbone and Marlean soils formed in 20 to 40 inches of loamy eolian sediment over limestone. Nordness soils have a thinner and lighter colored A horizon than that of Sogn soils and have an E horizon. Rockton and Winneshiek soils are well drained, formed in 20 to 40 inches of loamy sediment over limestone, and are upslope on the landscape. Terril soils are moderately well drained. They formed in more than 40 inches of loamy local alluvium on foot slopes and along drainageways lower on the landscape than Sogn soils.

Typical pedon of Sogn loam, 2 to 9 percent slopes, in a permanent pasture, on a convex upland side slope; 130 feet east and 717 feet south of the northwest corner of sec. 33, T. 87 N., R. 1 E.

A1—0 to 3 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; mildly alkaline; clear smooth boundary.

A2—3 to 14 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium and fine granular structure; friable; mildly alkaline; abrupt smooth boundary.

R—14 inches; level-bedded indurated limestone; dark colored soil in cracks and crevices.

The thickness of the solum and the depth to limestone range from 8 to 20 inches. Coarse fragments, less than 15 percent of the soil volume, are present in some pedons. The solum is neutral or mildly alkaline.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) and is 6 to 15 inches thick. The A horizon typically is loam or silt loam high in sand, but the range includes sandy loam. In some places, 1 to 5 inches of clayey or silty material is present just above the limestone.

Sparta Series

The Sparta series consists of excessively drained, rapidly permeable soils on outwash plains and on upland ridges and side slopes. These soils formed in more than 48 inches of sandy eolian sediment. The native vegetation was grasses. The slope ranges from 3 to 9 percent.

Sparta soils are similar to Chelsea soils and are commonly adjacent to Dickinson, Flagler, and Terril soils. Dickinson soils are somewhat excessively drained and formed in loamy eolian sediment. They are on landscape positions similar to those of Sparta soils. Flagler soils formed in 2 to 3 feet of stratified loamy alluvium underlain by sand and gravel and are downslope on high stream terraces. The moderately well drained Terril soils formed in loamy local alluvium; they have a thicker A horizon than that of Sparta soils and are downslope.

Typical pedon of Sparta loamy fine sand, 3 to 9 percent slopes, on a north-facing upland side slope in a hayfield; 450 feet west and 465 feet north of the southeast corner of sec. 32, T. 88 N., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; very weak fine and medium subangular blocky structure; very friable; neutral; abrupt smooth boundary.

A1—7 to 15 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; very weak fine subangular blocky structure; very friable; neutral; clear smooth boundary.

A2—15 to 22 inches; dark brown (10YR 3/3) loamy fine sand, brown (10YR 5/3) dry; very weak fine and medium subangular blocky structure; very friable; neutral; clear smooth boundary.

BA—22 to 29 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; very friable; few dark brown (10YR 3/3) coatings on faces of peds; slightly acid; clear smooth boundary.
Bw1—29 to 34 inches; dark yellowish brown (10YR 4/4) loamy fine sand; very weak fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.
Bw2—34 to 40 inches; yellowish brown (10YR 5/4) loamy sand; very weak fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.
C—40 to 60 inches; yellowish brown (10YR 5/6) sand; single grained; loose; strong brown (7.5YR 5/6) sandy loam iron band at 45 to 48 inches; few 1/4- to 1-inch chert fragments; slightly acid.

The thickness of the solum ranges from 24 to 40 inches. There are no carbonates in the upper 60 inches. The solum ranges from neutral to strongly acid and is loamy fine sand, loamy sand, fine sand, or sand.

The Ap or A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The BA horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 3 through 6. The C horizon has colors similar to those of the Bw horizon and is sand or fine sand.

Spillville Series

The Spillville series consists of somewhat poorly drained, moderately permeable soils on bottom lands along streams. These soils formed in loamy alluvium. The native vegetation was grasses. The slope ranges from 0 to 2 percent.

Spillville soils are similar to Terril soils and are commonly adjacent to Chaseburg and Huntsville soils. Chaseburg soils are silty and are upslope from Spillville soils. Huntsville soils also are silty. They and Spillville soils are in similar positions on the landscape.

Typical pedon of Spillville loam, 0 to 2 percent slopes, in a cultivated field on a bottom land; 1,000 feet south and 2,300 feet east of the northwest corner of sec. 26, T. 87 N., R. 2 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; slightly acid; abrupt smooth boundary.
A1—8 to 26 inches; black (10YR 2/1) loam high in very fine sand, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; neutral; gradual smooth boundary.
A2—26 to 40 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; about 1 percent fragments one-quarter inch in diameter; neutral; gradual smooth boundary.
C—40 to 60 inches; very dark grayish brown (10YR 3/2) loam; massive; very friable; few very dark brown (10YR 2/2) coatings in root channels; about 1 percent fragments one-quarter inch in diameter; slightly acid.

The thickness of the solum and of the mollic epipedon ranges from 36 to 45 inches.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2). Typically, it is loam, but in some pedons it has thin strata of fine sandy loam in the upper 10 inches. The A horizon is neutral to slightly acid. The C horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. In some pedons there are mottles below a depth of 36 inches.

Tama Series

The Tama series consists of well drained, moderately permeable soils on ridges and side slopes on the uplands. These soils formed in loess more than 60 inches thick. The native vegetation was grasses. The slope ranges from 2 to 9 percent.

Tama soils are similar to Downs soils and are commonly adjacent to Atterberry, Downs, Ely, Muscatine, and Newvienna soils. Atterberry soils have a lighter colored A horizon than that of Tama soils, and they have an E horizon. Atterberry and Muscatine soils have a grayer B horizon and are somewhat poorly drained. They are on upland divides, at the head of drainageways, and on the lower part of foot slopes. Downs and Newvienna soils have a thinner A horizon than that of Tama soils. Downs soils are on the lower part of side slopes below Tama soils. Newvienna soils are moderately well drained and have mottles at a depth of 23 to 30 inches. Newvienna soils are at the head of drainageways and on side slopes along drainageways below Tama soils. Ely soils are somewhat poorly drained; they formed in silty alluvium on upland foot slopes.

Typical pedon of Tama silt loam, 2 to 5 percent slopes, on a southeast-facing convex ridgetop; 420 feet east and 160 feet south of the northwest corner of sec. 1, T. 87 N., R. 2 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.
A1—8 to 12 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; slightly acid; clear smooth boundary.

A2—12 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate fine subangular blocky and moderate medium granular structure; friable; dark brown (10YR 3/3) coatings on faces of peds; medium acid; clear smooth boundary.

BA—18 to 23 inches; brown (10YR 4/3) and very dark grayish brown (10YR 3/2) silt loam (26 percent clay); moderate fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

Bt1—23 to 31 inches; yellowish brown (10YR 5/4) silty clay loam (28 percent clay); moderate medium subangular blocky structure; friable; few thin discontinuous brown (10YR 4/3) clay films; strongly acid; clear smooth boundary.

Bt2—31 to 38 inches; yellowish brown (10YR 5/4) silty clay loam (30 percent clay); weak medium prismatic structure parting to moderate medium subangular blocky; friable; few thin discontinuous brown (10YR 4/3) clay films; strongly acid; clear smooth boundary.

BC—38 to 49 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown (10YR 5/2) mottles; weak coarse prismatic structure; friable; few very fine black (10YR 2/1) concretions (manganese oxide); strongly acid; gradual smooth boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown (10YR 5/2) mottles; massive; friable; few fine black (10YR 2/1) concretions (manganese oxide); few one-eighth to one-half inch chert fragments; medium acid.

The thickness of the solum ranges from 3 to more than 5 feet. There are no carbonates in the upper 5 feet.

The A or Ap horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The thickness of the A horizon is 10 to 20 inches except in eroded areas. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon is silty clay loam and ranges in clay content from 28 to 34 percent. Mottles in the BC and C horizons range from few to none and are both high chroma and low chroma. The B horizon is medium acid or strongly acid.

Terril Series

The Terril series consists of moderately well drained, moderately permeable soils on foot slopes and alluvial fans on uplands. These soils formed in more than 40 inches of loamy local alluvium. The native vegetation was grasses. The slope ranges from 2 to 5 percent.

Terril soils are similar to Spillville soils and are commonly adjacent to Dickinson, Olin, Ostrander, Sogn, and Sparta soils. Dickinson soils are somewhat excessively drained and are upslope on the landscape. Olin and Ostrander soils formed partly in glacial till and are upslope from Terril soils. Sogn soils formed in 8 to 20 inches of loamy sediment over limestone and are upslope on the surrounding landscape. Sparta soils formed in eolian sediment and are upslope. Spillville soils are somewhat poorly drained and have a grayer C horizon than that of Terril soils.

Typical pedon of Terril loam, 2 to 5 percent slopes, in a hayfield, on a slightly concave north-facing upland foot slope; 1,315 feet east and 170 feet north of the southwest corner of sec. 33, T. 88 N., R. 2 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A1—8 to 16 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; slightly acid; clear smooth boundary.

A2—16 to 24 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak medium and fine subangular blocky structure; friable; medium acid; clear smooth boundary.

AB—24 to 30 inches; dark brown (10YR 3/3) loam, yellowish brown (10YR 5/4) dry; moderate medium and fine subangular blocky structure; friable; few very dark grayish brown (10YR 3/2) coatings on faces of peds; medium acid; clear smooth boundary.

Bw1—30 to 39 inches; dark yellowish brown (10YR 4/4) loam; moderate medium and fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bw2—39 to 48 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) loam; weak medium and fine subangular blocky structure; friable; few 1/4- to 1-inch chert fragments; medium acid; clear smooth boundary.

Bw3—48 to 54 inches; yellowish brown (10YR 5/4) loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few 1/4- to 1-inch chert fragments; medium acid; gradual smooth boundary.

BC—54 to 60 inches; yellowish brown (10YR 5/6) loam; weak coarse prismatic structure parting to weak medium subangular blocky; very friable; few 1/4- to 1-inch chert fragments; sandy loam lens at 54 to 56 inches; slightly acid.

The thickness of the solum ranges from about 3 to 5 feet. The depth to carbonates typically is more than 50 inches. Sand content throughout the solum typically is between 30 and 45 percent; the range is 25 to 50 percent. The solum is neutral to medium acid.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2 and is 24 to 36 inches thick. The A horizon typically is loam, but the range includes silt loam high in sand. The B horizon has value of 4 or 5 and chroma of 3 or 4. The B horizon typically is loam, but the range includes clay loam. The lower part of the B horizon and the C horizon have faint mottles in some pedons.

Volney Series

The Volney series consists of well drained, moderately rapidly permeable soils on alluvial fans and along narrow drainageways on uplands. These soils formed in channery silty alluvium. The native vegetation was mixed grasses and trees. The slope ranges from 2 to 5 percent.

Volney soils are commonly adjacent to Arenzville, Dorchester, and Nordness soils. Arenzville and Dorchester soils are moderately well drained and formed in silty alluvium on bottom lands. Nordness soils are underlain by limestone at a depth of 8 to 20 inches and are on side slopes and escarpments on uplands.

Typical pedon of Volney channery silt loam, in an area of Dorchester-Volney complex, 2 to 5 percent slopes, in a permanent pasture on a west-facing convex foot slope; 1,460 feet west and 1,680 feet north of the southeast corner of sec. 33, T. 91 N., R. 1 E.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) channery silt loam, grayish brown (10YR 5/2) dry; moderate medium and fine granular structure; friable; about 15 percent limestone fragments 1 inch to 1 1/2 inches in length; slight effervescence; mildly alkaline; clear smooth boundary.

A2—9 to 26 inches; very dark brown (10YR 2/2) channery silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; about 20 percent limestone fragments 3 to 5 inches in length; slight effervescence; mildly alkaline; clear wavy boundary.

C—26 to 60 inches; very dark grayish brown (10YR 3/2) very channery silt loam between limestone flagstones; massive; friable; about 65 percent limestone flagstones 6 to 20 inches thick; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 36 inches. The solum typically is channery silt loam, but the range includes channery loam that is 20 to 40 percent sand. The amount of coarse fragments of hard limestone is variable within short distances, but typically the content of coarse fragments increases with depth, ranging from 10 to 30 percent, by volume, in the surface layer to as much as 75 percent in the lower part of the solum. Reaction typically is mildly alkaline or moderately alkaline throughout the solum.

The A horizon typically is very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2), but the range includes black (10YR 2/1). The thickness of the A horizon is the same as that of the solum. The C horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. The C horizon is channery silt loam or loam between flagstones.

Wapsie Series

The Wapsie series consists of well drained soils on stream terraces and outwash plains. The soils formed in 18 to 32 inches of loamy alluvial deposits and in the underlying sandy alluvium. Permeability is moderate in the upper part of the solum and very rapid in the lower part of the solum and the substratum. The native vegetation was mixed grasses and trees. The slope ranges from 2 to 7 percent.

Wapsie soils are commonly adjacent to Burkhardt, Flagler, and Hayfield soils. Burkhardt and Flagler soils formed in coarser alluvium than Wapsie soils. They and Wapsie soils are in the same positions on the landscape. Hayfield soils have thicker loamy alluvium, are somewhat poorly drained, and are downslope on the landscape.

Typical pedon of Wapsie loam, 2 to 7 percent slopes, in a cultivated field on a northwest-facing convex outwash terrace; 1,900 feet north and 10 feet east of the southwest corner of sec. 29, T. 88 N., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

E—7 to 12 inches; brown (10YR 4/3) and very dark grayish brown (10YR 3/2) loam, pale brown (10YR 6/3) dry; moderate medium platy structure parting to weak fine subangular blocky; friable; common very dark gray (10YR 3/1) coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—12 to 16 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films; medium acid; clear smooth boundary.

Bt2—16 to 24 inches; brown (7.5YR 4/4) loam; moderate medium and fine subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films; strongly acid; clear smooth boundary.

Bt3—24 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films; 5 percent 1/4- to 1-inch pebbles; strongly acid; clear smooth boundary.

2BC—28 to 35 inches; strong brown (7.5YR 5/6) sand; weak medium prismatic structure parting to weak medium subangular blocky; very friable; 10 percent 1/4- to 1-inch pebbles; strongly acid; clear smooth boundary.

2C1—35 to 54 inches; yellowish brown (10YR 5/6) sand; single grained; loose; few chert fragments in the upper part; 10 percent 1/4- to 1 1/2-inch pebbles; strongly acid; clear wavy boundary.

2C2—54 to 60 inches; strong brown (7.5YR 5/6) coarse sand; single grained; loose; 10 percent 1/4- to 1-inch pebbles; slightly acid.

The thickness of the solum ranges from 24 to 40 inches. Depth to the underlying material ranges from 20 to 30 inches, but it is the same as the thickness of the solum in some pedons. Depth to carbonates commonly is more than 6 feet.

The A or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The E horizon is mostly mixed into the Ap horizon in some pedons. The A and E horizons typically are loam, but the range includes sandy loam and sandy clay loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 6. It typically is loam and grades to sandy loam or gravelly sandy loam in the lower part. The clay content of the Bt horizon ranges from 15 to 22 percent, but the weighted average of the control section to a contrasting texture is less than 18 percent. The Bt horizon ranges from slightly acid to strongly acid. The 2C horizon is yellowish brown (10YR 5/6 or 5/8) or strong brown (7.5YR 5/6 or 5/8) sand or coarse sand.

Winneshiek Series

The Winneshiek series consists of well drained, moderately permeable soils on ridgetops and side slopes on uplands. These soils formed in 20 to 30 inches of loamy glacial till and thin clayey residuum over limestone. The native vegetation was mixed grasses and trees. The slope ranges from 3 to 9 percent.

Winneshiek soils are similar to Rockton soils and are commonly adjacent to Backbone, Racine, and Sogn soils. Backbone soils formed in eolian sediment and the underlying limestone and are lighter in color than Winneshiek soils. They and Winneshiek soils are in similar positions on the landscape. Racine soils formed in loamy sediment and the underlying glacial till and are upslope on the landscape. Rockton soils have a thicker and darker A horizon and do not have an E horizon. Sogn soils are somewhat excessively drained and are underlain by limestone at a depth of less than 20 inches. They are downslope from Winneshiek soils.

Typical pedon of Winneshiek loam, 20 to 30 inches to limestone, 3 to 9 percent slopes, in a hayfield on a southeast-facing convex upland side slope; 1,800 feet south and 290 feet east of the northwest corner of sec. 6, T. 88 N., R. 2 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) loam, very dark grayish brown (10YR 3/2) rubbed, gray (10YR 5/1) and grayish brown (10YR 5/2) dry; weak fine subangular blocky and granular structure; friable; medium acid; abrupt smooth boundary.

E—8 to 13 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/3) dry; few very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to weak fine subangular blocky; friable; medium acid; clear smooth boundary.

BE—13 to 17 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) loam; weak medium and moderate fine subangular blocky structure; friable; medium acid; clear smooth boundary.

Bt1—17 to 23 inches; dark yellowish brown (10YR 4/4) loam (26 percent clay); moderate medium and fine subangular blocky structure; friable; thin continuous brown (7.5YR 4/4) clay films; few 1/4- to 1-inch chert fragments; slightly acid; abrupt wavy boundary.

2Bt2—23 to 27 inches; reddish brown (5YR 4/4) silty clay; strong medium and fine subangular blocky structure; very firm; thin continuous reddish brown (5YR 4/4) clay films; common 1/4- to 1-inch chert fragments; few dark brown (7.5YR 3/2) coatings on faces of peds in the lower part; neutral; abrupt wavy boundary.

2R—27 inches; about 3/4 inch soft limestone over hard fractured limestone.

The thickness of the solum and depth to limestone bedrock are 20 to 30 inches. There are no carbonates above the limestone.

The Ap or A horizon is 6 to 9 inches thick. The E horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3) and is 2 to 5 inches thick. The upper part of the B horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The 2B horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 through 6. In some pedons, the 2B horizon is evident only as thin rinds around limestone flags or is as much as 6 inches thick. Typically, it is silty clay, but the range includes clay loam. The B horizon is slightly acid to medium acid in the most acid part.

Worthen Series

The Worthen series consists of well drained, moderately permeable soils on foot slopes. These soils formed in more than 40 inches of silty local alluvium. The slope ranges from 2 to 5 percent.

Worthen soils are similar to Ely and Huntsville soils and are commonly adjacent to Downs, Otter, and Tama soils. Ely soils are somewhat poorly drained. Downs and Tama soils have an argillic horizon and are higher on the landscape. Huntsville soils have a thicker A horizon and are on second bottoms. Otter soils are poorly drained and are on flood plains lower on the landscape.

Typical pedon of Worthen silt loam, 2 to 5 percent slopes, in a cultivated field on a west-facing foot slope; 1,300 feet west and 2,260 feet south of the northeast corner of sec. 30, T. 87 N., R. 1 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1A—8 to 14 inches; very dark grayish brown (10YR 3/2) and black (10YR 2/1) silt loam; dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A2—14 to 25 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to moderate medium and fine granular; friable; slightly acid; gradual smooth boundary.

A3—25 to 29 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 4/3) dry; weak medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

BA—29 to 34 inches; brown (10YR 4/3) silt loam with dark brown (10YR 3/3) coatings; weak medium subangular blocky structure; friable; discontinuous clear very fine silt and sand coatings on faces of peds; slightly acid; clear smooth boundary.

Bw—34 to 48 inches; brown (10YR 4/3) silt loam (26 percent clay); weak medium prismatic structure parting to weak medium subangular blocky; friable; few thin discontinuous dark brown (10YR 3/3) clay films; discontinuous clean very fine silt and sand coatings on faces of peds; slightly acid; gradual smooth boundary.

BC—48 to 55 inches; yellowish brown (10YR 5/4) silt loam (26 percent clay); few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; friable; discontinuous clean very fine silt and sand coatings on faces of peds; slightly acid; clear smooth boundary.

C—55 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. Depth to carbonates is more than 60 inches. The solum typically is neutral or slightly acid.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The mollic epipedon is 24 to 36 inches thick. The B horizon is brown (10YR 4/3) or yellowish brown (10YR 5/4 or 5/6). Clay content ranges from 18 to 27 percent. In some pedons there are faint mottles in the lower part of the B horizon. The C horizon is yellowish brown (10YR 5/4, 5/6, or 5/8) or strong brown (7.5YR 5/6).

Zwingle Series

The Zwingle series consists of poorly drained, very slowly permeable soils on high stream terraces. The native vegetation was trees. The slope ranges from 2 to 7 percent.

Zwingle soils are commonly adjacent to Dorchester, Medary, and Nordness soils. Dorchester soils are moderately well drained and formed in silty alluvium on bottom lands. Medary soils are moderately well drained and are on escarpments along stream terraces. Nordness soils are well drained, are underlain by limestone at a depth of 8 to 20 inches, and are on escarpments on uplands.

Typical pedon of Zwingle silt loam, 2 to 7 percent slopes, in a grassy area on a high stream alluvial terrace; 2,820 feet west and 2,730 feet north of the southeast corner of sec. 34, T. 90 N., R. 2 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

E—5 to 9 inches; grayish brown (10YR 5/2) and gray (10YR 5/1) silt loam, light gray (10YR 7/2 and 7/1) dry; moderate thin platy structure; friable; medium acid; abrupt smooth boundary.

Bt1—9 to 18 inches; brown (7.5YR 4/4) silty clay (42 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; firm; few thin discontinuous brown (7.5YR 4/2) clay films; thin discontinuous silt coatings on peds; medium acid; clear smooth boundary.

Bt2—18 to 29 inches; brown (10YR 4/3) silty clay (45 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few thin discontinuous brown (7.5YR 4/2) clay films; thin continuous brown (10YR 5/3) silt coatings on peds; strongly acid; clear smooth boundary.

Bt3—29 to 36 inches; brown (10YR 4/3) silty clay (42 percent clay); common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; friable; thin discontinuous brown (7.5YR 4/2) clay films; medium acid; gradual smooth boundary.

BC—36 to 48 inches; dark yellowish brown (10YR 4/4) silt loam and strata of silty clay loam (28 percent clay); common medium distinct strong brown (7.5YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure; friable; few thin discontinuous brown (7.5YR 4/2) clay films; strata of dark yellowish brown (10YR 4/4 and 4/6) loam at 37 to 40 inches; neutral; gradual smooth boundary.

2C—48 to 60 inches; stratified dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), and brown (10YR 5/3) silty clay loam (27 percent clay) and strata of loam and fine sandy loam; massive; friable; brown (7.5YR 4/4) iron stains; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. There are no carbonates in the upper 48 inches.

The A horizon is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2) and is 2 to 5 inches thick. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2 and is 4 or 5 inches thick. In cultivated areas, the E horizon is mixed into the Ap horizon. The Ap horizon typically is silt loam, but the range includes silty clay loam. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 2 through 6. The Bt horizon is silty clay or clay; the clay content ranges to 60 percent. Reaction is medium acid or strongly acid in the Bt horizon. The BC and C horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 through 6.

Formation of the Soils

In this section factors that affect the formation of soils in Dubuque County are discussed. The formation that has taken place in the county involved many steps and processes. All are important in the development of soil.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material(*7*).

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. A long time 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. Many of the processes of soil formation are unknown.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. Some thin layers of a few soils in the county formed as the result of weathering of bedrock. Most of the soils, however, formed in material that was transported from the site of the parent rock and redeposited at a new location through the action of glacial ice, water, wind, and gravity.

The principal parent materials in Dubuque County are glacial drift, loess, alluvium, residuum, and eolian, or wind-deposited, sand. Much less extensive parent materials are organic deposits.

Loess, a silty material deposited by wind, covers about 80 percent of Dubuque County. It ranges in depth from about 2 to 10 feet and mainly is underlain by glacial till, limestone, and shale. In about 90 percent of the latter areas, the loess is more than 5 feet thick; the remaining areas are covered by 2 to 5 feet of loess. Loess consists mostly of silt and some clay. It is generally calcareous when unweathered. It does not contain coarse sand or gravel because those materials are too large to be moved by wind. It does contain small amounts, generally less than 5 percent, of very fine sand.

In Dubuque County the Atterberry, Downs, Fayette, Muscatine, Rozetta, Seaton, and Tama soils formed in more than 5 feet of loess. The Dubuque soils formed in 20 to 40 inches of loess underlain by limestone, and Eleroy and Schapville soils formed in loess underlain by shale.

Glacial drift is rock material that was deposited by glacial ice. It includes glacial till, which is unsorted sediment that ranges in size from boulders to particles (*16*). Glacial drift is a less extensive parent material in Dubuque County. At least twice during the glacial period, continental ice or glaciers moved over the land. The record of these ice invasions is contained in the unconsolidated rock material that was deposited by the melting ice and melt water streams. The older ice sheet, known as the Nebraskan, occurred some 750,000 years age (*8, 12*). It was followed by the Aftonian interglacial period. The Kansan glaciation is thought to have started about 500,000 years ago.

In 1933, a more recent glaciation was recognized by Leighton (*9*) as the Iowan substage of the Wisconsin glaciation, 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 eroded surfaces and that many of the levels cut into Kansan and Nebraskan till. Ruhe's study (*16*) demonstrated that Iowan till does not exist but an erosion-surface complex does exist in the Iowan region. The Iowan surface is multilevel and is arranged in a series of steps from major drainageways toward bounding divides. The Iowan surface is marked by a stone line where it cuts into Kansan and Nebraskan till.

The stone line is on all levels of the stepped surfaces, and it passes under the alluvium along drainageways.

The soils that formed in the glacial drift and glacial till on the Iowan erosion surface are the Basset, Clyde, Floyd, Kenyon, Ostrander, Racine, and Schley soils. The Bassett and Kenyon soils have loamy surficial sediment that is about 2 feet thick over the glacial material (fig. 17). On the lower part of toe slopes are Ostrander and Racine soils that have more than one stone line and are deeper to firm till. Friable till is interbedded between the loamy sediment and firm glacial till. On the lower, concave slopes and along waterways, the loamy sediment is deeper over glacial till. The Clyde, Floyd, and Schley soils formed on this terrain. A stone line or pebble band commonly separates the friable, loamy surficial sediment from the firm, loamy glacial till.

In Dubuque County there are also soils that formed in glacial till in the loess-covered uplands. The process of geologic erosion removed the loess from many steep side slopes and exposed the glacial till material. The Lindley soils are an example.

Alluvium consists of sediment that has been deposited by water. Alluvial deposits of Late Wisconsin age occur on flood plains and terraces in the county. About 4 percent of the soils formed in waterlaid materials. The major areas in which soils formed in alluvium are along the North Branch of the Little Maquoketa and Mississippi Rivers and Catfish Creek and tributaries of these streams. Large flood plains are along the Mississippi and Maquoketa Rivers, and a stream terrace of about 600 acres is along the Mississippi River north of the city of Dubuque.

Much of the alluvium in this county washed from soils on loess-covered slopes in the uplands. Much of the alluvial sediment is silty and low in content of sand. Examples of silty soils that formed in alluvium are the Arenzville, Chaseburg, Huntsville, Lawson, and Otter soils. Loamy soils that also formed in alluvium but have more sand than the silty soils are the Spillville and Terril 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 are calcareous. Examples of soils that formed in calcareous alluvium are the Caneek, Dorchester, and Volney soils. The other alluvial soils on flood plains are free of carbonates and 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 from which it was eroded. The Worthen soil is an example; it is at the foot of slopes directly below loess-derived soils.

The soils on terraces or second bottoms also consist of alluvium and vary in texture. These soils are above the present flood plain and generally are not flooded. Most are underlain by coarser textured material within a depth of 4 to 6 feet. The Coppock and Festina soils formed in silty alluvium, and the Wapsie and Hayfield soils formed in loamy alluvium underlain by coarse sand and gravel.

Lacustrine deposits. The unique fluvio-lacustrine deposits in Dubuque County are along the Mississippi River and its tributaries. The lacustrine sediment is composed of 3 to 5 feet of fine clay over stratified silt deposits. According to recent studies (*10*) the source of this material was the pre-existing glacial lake located at the headwaters of the Mississippi River. The sediment

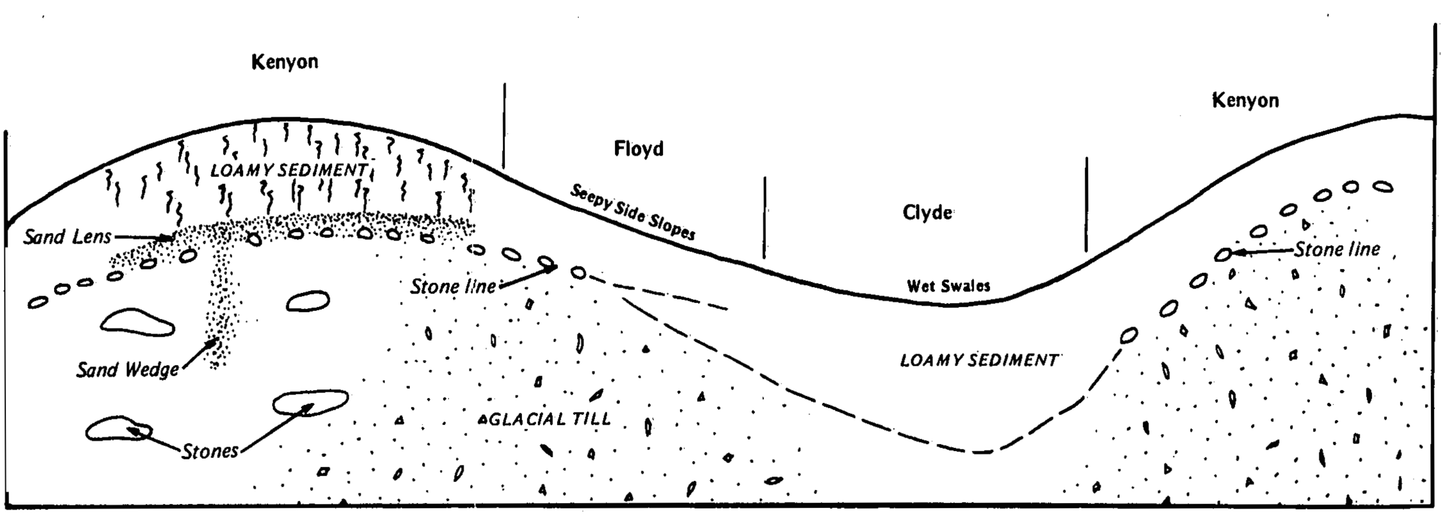

Figure 17.—Parent materials of Kenyon, Floyd, and Clyde soils.

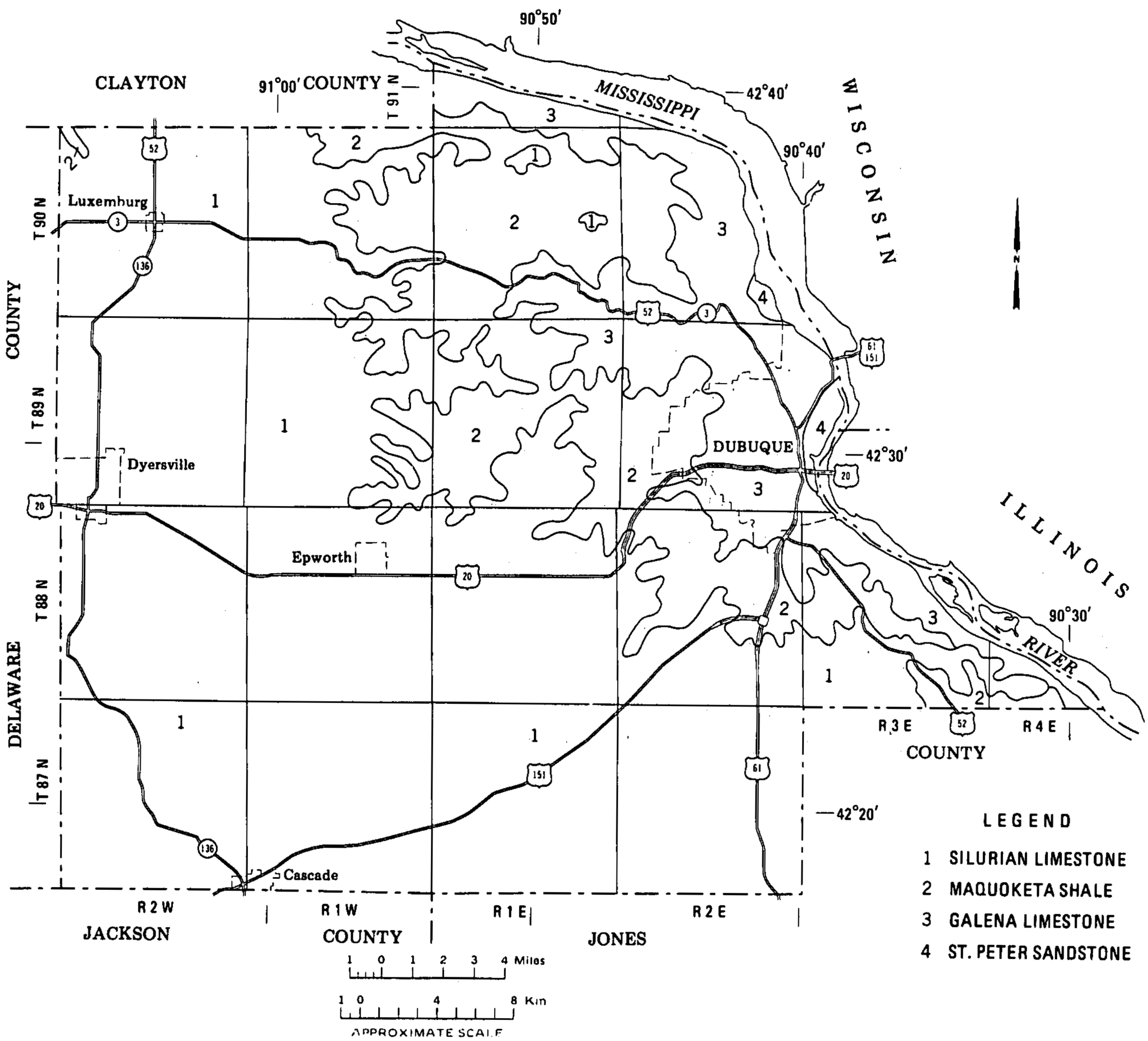

Figure 18.—Bedrock stratigraphy in Dubuque County.

was carried down the Mississippi River channel and held in suspension by the turbulent water. As the water invaded the tributaries, the turbulence diminished. Then, as the water evaporated, gently receded, or soaked into the soil mantle, sediment high in clay was left behind. Later, as the Mississippi River cut its channel deeper into the surface, these deposits were left on high terraces. It is believed this sediment is relatively recent because it settled on the loess after deposition of loess ceased some 14,000 years ago. Medary and Zwingle soils formed on these terraces.

Residuum and bedrock formations. Residuum is the material derived from the weathering of sedimentary rock in place. Limestone, sandstone, and shale are the types of sedimentary rock in Dubuque County. The bedrock formations in the county are part of the Ordovician and Silurian systems (*3, 5*). The rocks of the Ordovician system were deposited about 425 to 500 million years ago (*14, 21*) and comprise the Maquoketa Shale, Galena Limestone, and St. Peter Sandstone Formations (*13*). These rocks outcrop along the Mississippi and Little Maquoketa Rivers and Catfish Creek (fig. 18). The rest

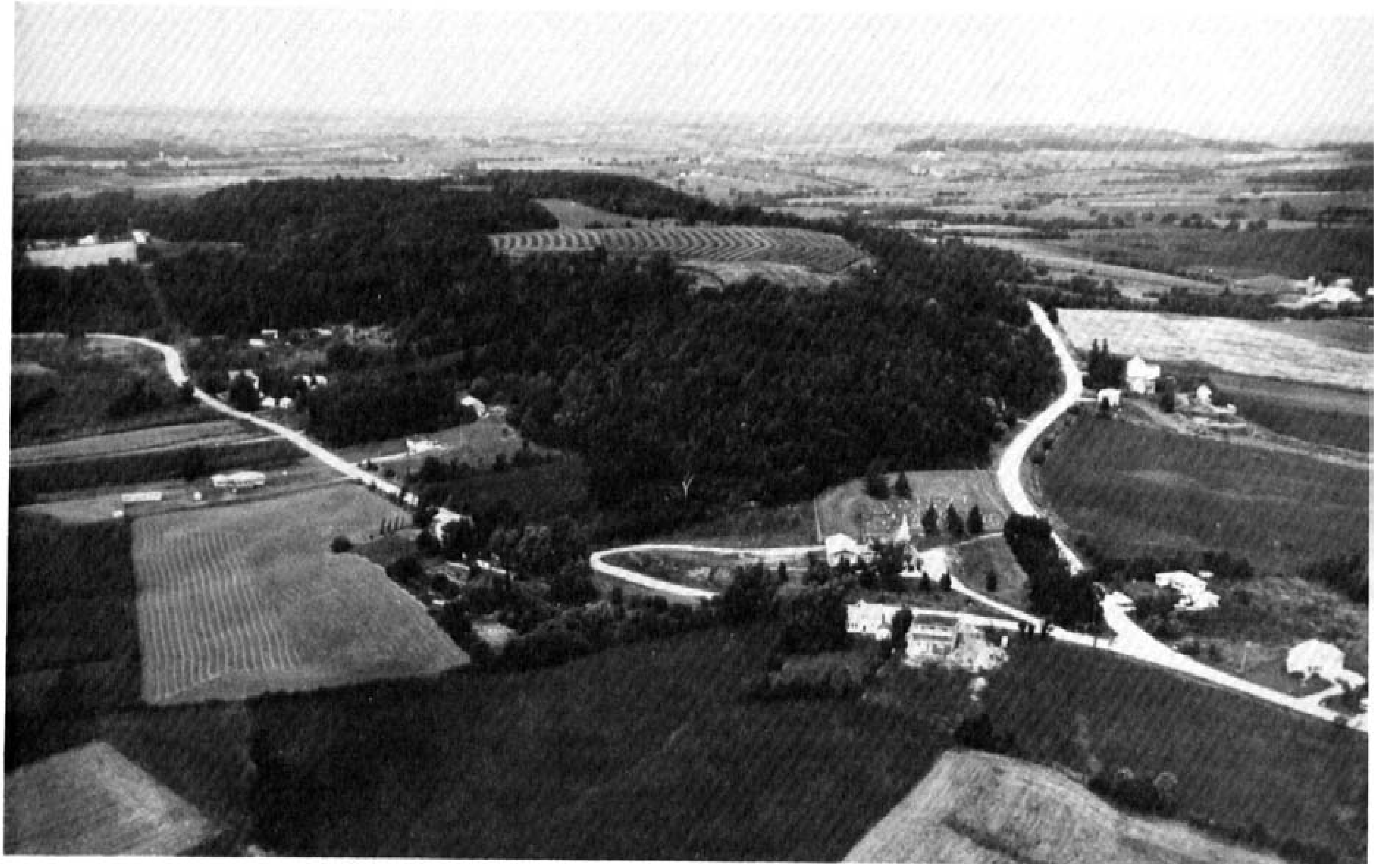

Figure 19.—A mound near Sherrill is one of many scattered throughout the eastern one-third of the county. The escarpment typically is covered with trees. The mounds are remnants of Silurian limestone.

of the county to the west and southwest is underlain by rocks of the Silurian system, 405 to 425 million years old, and is made up of Edgewood, Kankakee, and Hopkinton Limestone Formations. A number of mounds of Silurian age are in the eastern one-third of the county (fig. 19). They are surrounded by the Maquoketa Shale.

Sogn and Nordness soils are shallow over limestone. Nordness soils formed partly in silty sediment and partly in material weathered from the limestone bedrock. Nordness soils are underlain by rocks of either the Ordovician or the Silurian system. Sogn soils formed in loamy residuum of limestone and are on rocks of only the Silurian system. Rollingstone soils, however, formed almost entirely from residuum in areas of the Hopkinton Formation of the Silurian system. Eleroy and Schapville soils formed partly in loess and partly in shale residuum of the Maquoketa Formation of the Ordovician system. Lamont and Dickinson soils are on high stream terraces along the Mississippi River near the city of Dubuque and are underlain by St. Peter Sandstone.

In this county, the layer of residuum typically is less than 6 inches thick over unweathered bedrock. In most places, a deposit of loess or glacial drift covers this residuum. Loess covers the thin layer of residuum over limestone in the Dubuque soils, and loess covers residuum over shale in the Eleroy soils. Rockton and Winneshiek soils formed in loamy material covering residuum over limestone. In some places, 2 to 8 feet of glacial drift is interbedded between 5 to 10 feet of loess and the residuum weathered from shale. Within the Maquoketa Formation, generally about 1/2 mile downslope from the Silurian escarpment, the areas of glacial drift occur as remnants capping the more gentle slopes of the shale bedrock (fig. 20). The residuum of both limestone and shale commonly has texture of silty clay or clay. The residuum weathered from limestone commonly has a reddish hue, but the residuum weathered from shale ranges more from yellow to olive gray.

Climate

According to available evidence, the soils of the county have been forming under the influence of a midcontinental subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to the growth of forest vegetation (*15, 27*). The morphology of most of the soils in the county indicates that the climate under which the soils formed is similar to the present one. At present, the climate is fairly uniform throughout the county but is marked by wide seasonal extremes in temperature. Precipitation is distributed throughout the year.

Climate is a major factor in determining what soils develop from the various parent materials. The rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil are influenced by the climate. Temperature, rainfall, relative humidity, and length of the frost-free period are important in determining the vegetation.

The influence of the general climate of the region is somewhat modified by the local conditions in or near the developing soil. For example, south-facing, dry, sandy slopes have a local climate, or microclimate, that is warmer and less humid than the average climate in nearby areas. Low-lying, poorly drained areas are wetter and colder than most areas around them. These

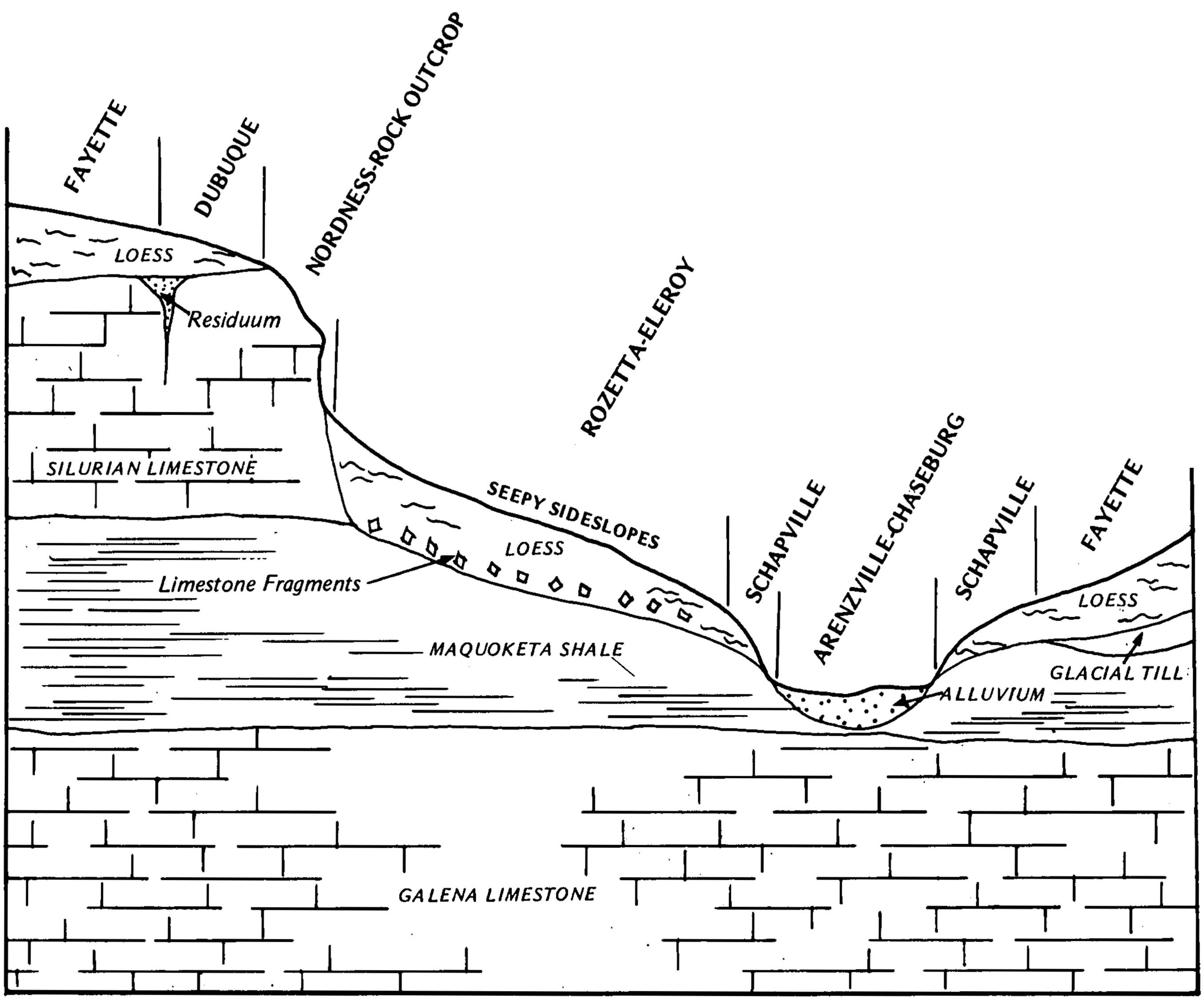

Figure 20.—A cross section of a typical pattern of soils and underlying material in a landscape controlled by limestone and shale.

contrasts account for some of the differences in the soils within the same general climatic region.

Plant and Animal Life

Plant and animal life are important factors in soil formation. Plant life is especially significant. Soil formation really begins with the coming of vegetation. As plants grow and die, they add organic matter to the upper layers of soil material. The native grasses have myriads of fibrous roots that penetrate the soil to a depth of 10 to 20 inches and add large amounts of organic matter to the surface layer. Trees commonly feed on plant nutrients deep in the subsoil; consequently, they add little organic matter to the surface layer, other than that gained from falling leaves and dead trees. Much of the organic matter from dead trees remains on the surface or is lost through decomposition.

Kenyon and Tama soils typically formed under prairie grasses (*26*). Clyde and Otter soils are representative of soils that formed under grasses and water-tolerant plants. Dubuque, Fayette, and Lindley soils typically formed under trees. Atterberry, Downs, and Bassett soils have properties intermediate between those of the soils that formed entirely under forest and those that formed under prairie grasses. Soils that formed under trees have a thin, dark surface layer generally less than 5 inches thick. They have a lighter colored E horizon immediately below the surface layer. In contrast, soils that formed under prairie vegetation contain a large amount of organic matter derived from roots, and they have a thick, dark surface layer.

The Tama, Downs, and Fayette soils are members of a biosequence, or a group of soils that formed in the same parent material and in a comparable environment except for native vegetation. The native vegetation has caused the main differences in morphology among the soils in this group.

Activities of burrowing animals and insects have some effect in loosening and aerating the upper few feet of the soils. Man's removal of trees and subsequent cultivation of crops tend to cause some soils to have a somewhat thicker, darker surface layer. In some sloping areas, however, cultivation followed by erosion has removed much of the dark surface layer.

Relief

Relief, or topography, is an important cause of differences among soils (*25*). Indirectly, it influences soil development through its effect on drainage. In Dubuque County, the relief ranges from nearly level to very steep. Many nearly level areas are frequently flooded and, periodically, have a high water table. Water soaks into the nearly level areas that are not flooded. In more sloping areas, much of the rainfall runs off the surface and less water penetrates the soil.

The Clyde and Otter soils formed under a high or periodically high water table and generally have a dominantly olive-gray subsoil. Soils that formed in areas where the water table was below the subsoil have a yellowish-brown subsoil, like Downs, Fayette, Festina, and Tama soils. Such soils as Atterberry, Coppock, Floyd, Hayfield, and Schley soils formed where natural drainage was intermediate, and they have a mottled grayish-brown subsoil. Of the soils that formed under prairie, those that have a high water table generally have more organic matter in the surface layer than those that have good natural drainage.

Aspect, as well as gradient, has significant influence. 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 prevail over the influence of topography. Although Flagler soils are no more than gently sloping, they are somewhat excessively drained because they have moderately rapid permeability in the subsoil and very rapid permeability in the substratum.

The nearly level Huntsville, Lawson, and Otter soils are examples of soils that formed in the same kind of parent material under similar vegetation and that differ because of slight differences in topographic position. Their microrelief affects runoff and depth to the water table. The Otter soils are on low elevations on bottom lands. They have a high water table and impound water for short periods of time. Lawson soils are on slightly higher elevations on low stream terraces and are somewhat poorly drained. The Huntsville soils, although nearly level, are on the higher elevations on low stream terraces and are well drained.

The Terril and Worthen soils are on foot slopes and along some upland drainageways. They have properties related to the soils upslope from which they receive sediment.

Because many of the Nordness soils are steep, they have very little soil development. Most of the water that falls on the surface layer runs off.

Time

Time is necessary for the various processes of soil formation to take place. The amount of time necessary ranges from a few days for the formation of fresh alluvial deposits, as in Fluvents, to a thousand years or more for the subsoil in many of the older upland soils. Older or more strongly developed soils show well defined genetic horizons. The Downs and Fayette soils are examples. A less well developed soil shows only weakly that formed horizons. Some of the soils that formed in alluvium show little or no profile development because fresh material is deposited periodically. These materials 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 materials is leached out as the soils continue to weather. Exceptions are soils that formed in quartz sand, such as the Sparta soils, or in other materials that are resistant to weathering. Such soils do not change much over a long period of 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 more slowly than soils in stable, less sloping areas.

Where organic materials, such as trees, have been buried by later deposition through the action of ice, water, or wind, the age of a landscape can be determined by radiocarbon dating (*17*).

The loess in which the Downs, Fayette, and Tama soils of this region formed is probably about 14,000 to 20,000 years old. Recent studies show that the Iowan erosion surface formed during the time of loess deposition. Radiocarbon dates show this to be between 14,000 and 20,000 years ago. The Iowan surface, where covered by loamy surficial sediment, is younger than 14,000 years (*18*), and soils on the slopes are probably much younger. Such soils as Bassett and Kenyon soils are on this surface. The Clyde and Floyd soils are younger, because they are cut in and below these higher lying soils. Time is needed for soil development, but the age of the parent material does not necessarily reflect the true age of the soil profile that formed in that material.

Man's Influence on the Soil

Important changes took place when man settled Dubuque County. Some changes had little effect on soil productivity; others had drastic effects. Breaking the prairie sod, clearing the timber, and changing the protective cover caused water erosion to be most apparent. Cultivation changes the soil by making the sloping areas more susceptible to erosion, which removes the topsoil, organic matter, and plant nutrients. Sheet erosion, which is the most prevalent in this county, removes a few inches of topsoil at a time, but cultivation generally destroys all evidence of this loss. In other places, shallow and deep gullies have formed, depositing the eroded materials on the lower part of the slopes. As the land was brought under cultivation, the surface runoff increased and the rate at which water moved into the soil decreased. This resulted in accelerated erosion that has removed part or all of the original surface layer from much of the sloping soils under cultivation.

Erosion has changed not only the thickness of the surface layer, but its structure and consistence as well. In severely eroded areas, the plow layer commonly consists partly of the upper part of the subsoil, which is less friable and finer in texture than the surface layer.

Erosion and cultivation also affect the soil by reducing the organic matter content and lowering fertility. Even in areas not subject to erosion, compaction by heavy machinery reduces the thickness of the surface layer and changes the structure. The granular structure, so apparent in natural grassland, breaks down under intensive cropping. The surface soil tends to bake and become hard when dry. The fine textured soils that have been plowed continuously when wet tend to puddle and are less permeable than similar soils in undisturbed areas.

In many places, dark colored, low-lying soils have received deposits of lighter colored material. Soils that developed in recent alluvium and that show the influence of man are the Arenzville, Caneek, and Dorchester soils. They have strata of light and dark colored materials washed from the hillsides and deposited by flooding. This erosion has taken place since man began cultivating the hillsides.

Man, however, has done much to increase productivity, to decrease soil loss, and to reclaim areas not suitable for crops or pasture. For example, terraces, erosion control structures, and other management practices have slowed or, in some places, controlled runoff and erosion. The establishment of diversions at the base of slopes and of drainage ditches and the use of other practices have aided in the prevention of flooding and deposition and have made large areas of bottom land suitable for cultivation.

Through the use of commercial fertilizers and lime, many soils are more productive now than they were in their natural state.

Erosion is a main cause of the reduction of organic matter content in soils. However, data indicate that as much as one-third of the organic matter can be lost from causes other than erosion (*20*). Management practices have shown that it is not economically feasible to maintain as high a level of organic matter as was originally present under native grasses, but it is necessary to maintain a safe and economical level for crops. In soils lowest in organic matter content, this is done by controlling the erosion of loess by water.

Processes of Horizon Differentiation

Horizon differentiation is considered to be caused by four basic kinds of change. These are additions, removals, transfers, and transformations in the soil system (*19*). Each of these four kinds of changes affects many substances that compose soils. For example, there may be additions, removals, transfers, or transformations of organic matter, soluble salts, carbonates, sesquioxides, or silicate clay minerals. In general, these processes tend to promote horizon differentiation, but some tend to offset or retard it. These processes and the changes they bring about continue simultaneously in soils, and the ultimate nature of the profile is governed by the balance of these changes.

An accumulation of organic matter is an early step in the process of horizon differentiation in most soils. Soils range from very high to very low in the amount of organic matter that has accumulated in the A horizon. Fayette soils, for example, have a thin A horizon that is low in organic matter content. Clyde soils have a thicker A horizon in which the content of organic matter is high. Some soils that were formerly quite high in organic matter content are now low because of erosion. The accumulation of organic matter has been an important process in the differentiation of soil horizons.

The process through which substances are removed from parts of the soil profile is important in the differentiation of soil horizons. The movement of calcium carbonates and bases downward in soils is an example. All the soils in the county, except the Caneek and Dorchester soils, have been leached free of calcium carbonates in the upper part of the profile, and some soils have been so strongly leached that they are strongly acid or very strongly acid in the subsoil.

Several kinds of transfer of substances from one horizon to another are evident in the soils of this county.

Phosphorus is removed from the subsoil by plant roots and transferred to parts of the plant growing above the ground. Then it is added to the surface layer in the plant residue. These processes affect the forms and the distribution of phosphorus in the profile.

The translocation of silicate clay minerals is an important process in horizon differentiation. The clay minerals are carried downward in suspension in percolating water from the A horizon. They accumulate in the B horizon in pores and root channels and as clay films on ped faces. In Dubuque County, this process has had an influence on the profiles of many soils. In other soils, the clay content is not markedly different in the A and B horizons and other evidence of clay movement is minimal.

Another kind of transfer, which is minimal in most soils but occurs to some extent in very clayey soils, is that brought about by shrinking and swelling. This causes cracks to form, so that some material of the surface layer can be moved down into the lower part of the profile. Medary and Zwingle soils are examples of soils in which this kind of physical transfer can take place.

Transformations are physical and chemical. For example, soil particles are weathered to smaller sizes. The reduction of iron is another example of a transformation. This process is called gleying and involves the saturation of the soil with water for long periods in the presence of organic matter. It is characterized by the presence of ferrous iron and gray colors. Gleying is associated with poorly drained soils, such as Otter soils. Reductive extractable iron, or free iron, is normally lower in somewhat poorly drained soils, such as the Lawson soils.

Still another kind of transformation is the weathering of the primary apatite mineral present in soil parent materials to secondary phosphorus compounds. At a pH near 7, apatite is weathered to secondary phosphorus compounds. Thus, soils that have a pH of more than 7, such as Dorchester soils, are lower in available phosphorus than soils that have a pH near 7, such as Otter soils.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Benches (geologic). Higher, older terraces (old alluvial plain) that are now a part of the erosion surface of the valley. In Iowa, the benches are of pre-Wisconsin age and are covered with loess.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

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, 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.

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.

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.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an 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.

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.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

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 the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Paleosol. A buried soil or formerly buried soil, especially one that formed during an interglacial period and was covered by deposits of later glaciers.

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.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

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.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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.

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.

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 of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, 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.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the 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."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-79 at Dubuque, Iowa]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	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----	26.6	9.7	18.2	49	-21	0	1.05	0.37	1.60	3	8.6
February---	32.3	14.8	23.6	54	-18	0	.94	.32	1.45	3	6.4
March------	42.3	25.6	34.0	72	-4	17	2.18	1.00	3.18	6	6.3
April------	58.1	39.3	48.7	82	22	85	3.39	2.16	4.49	7	1.4
May--------	70.3	51.2	60.8	90	34	346	3.50	1.84	4.94	7	.0
June-------	79.3	60.9	70.1	93	46	603	3.95	1.97	5.67	7	.0
July-------	83.1	65.2	74.2	95	52	750	3.57	1.57	5.26	6	.0
August-----	81.3	63.3	72.3	94	49	691	3.81	1.54	5.72	6	.0
September--	73.5	54.9	64.2	91	36	426	3.44	1.08	5.36	6	.0
October----	62.8	44.6	53.7	85	26	188	2.28	.50	3.68	5	.0
November---	46.2	30.8	38.5	69	6	12	1.83	.53	2.87	4	1.8
December---	32.6	17.8	25.2	59	-16	0	1.37	.65	1.98	4	7.7
Yearly---	57.4	39.8	48.6	96	-23	3,118	31.31	25.31	36.98	64	32.2

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-79 at Dubuque, Iowa]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 10	April 20	May 4
2 years in 10 later than--	April 6	April 16	April 30
5 years in 10 later than--	March 31	April 8	April 21
First freezing temperature in fall:			
1 year in 10 earlier than--	October 29	October 16	October 2
2 years in 10 earlier than--	November 2	October 21	October 9
5 years in 10 earlier than--	November 10	November 1	October 21

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-79 at Dubuque, Iowa]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	206	187	156
8 years in 10	212	193	165
5 years in 10	223	206	182
2 years in 10	234	219	200
1 year in 10	240	225	208

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
27B	Terril loam, 2 to 5 percent slopes	1,430	0.4
41C	Sparta loamy fine sand, 3 to 9 percent slopes	615	0.2
63C	Chelsea loamy fine sand, 5 to 9 percent slopes	1,265	0.3
63D	Chelsea loamy fine sand, 9 to 16 percent slopes	1,550	0.4
63F	Chelsea loamy fine sand, 18 to 25 percent slopes	840	0.2
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	485	0.1
65F	Lindley loam, 18 to 30 percent slopes	515	0.1
83B	Kenyon loam, 2 to 5 percent slopes	2,160	0.5
83C	Kenyon loam, 5 to 9 percent slopes	635	0.2
84	Clyde loam, 0 to 2 percent slopes	1,005	0.3
97	Lawson-Huntsville silt loams, 0 to 2 percent slopes	480	0.1
109C	Backbone fine sandy loam, 5 to 9 percent slopes	1,090	0.3
109D	Backbone fine sandy loam, 9 to 14 percent slopes	480	0.1
110B	Lamont fine sandy loam, 2 to 5 percent slopes	390	0.1
110C	Lamont fine sandy loam, 5 to 9 percent slopes	1,065	0.3
110D	Lamont fine sandy loam, 9 to 14 percent slopes	440	0.1
119	Muscatine silt loam, 1 to 3 percent slopes	425	0.1
120B	Tama silt loam, 2 to 5 percent slopes	2,935	0.7
120C	Tama silt loam, 5 to 9 percent slopes	6,470	1.6
120C2	Tama silt loam, 5 to 9 percent slopes, moderately eroded	350	0.1
129B	Chaseburg-Arenzville silt loams, 0 to 5 percent slopes	11,320	2.8
142	Chaseburg silt loam, 0 to 2 percent slopes	4,915	1.2
152	Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	320	0.1
158	Dorchester silt loam, 0 to 2 percent slopes	2,685	0.7
162B	Downs silt loam, 2 to 5 percent slopes	2,840	0.7
162C	Downs silt loam, 5 to 9 percent slopes	9,910	2.5
162C2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	15,505	3.9
162D	Downs silt loam, 9 to 14 percent slopes	5,015	1.3
162D2	Downs silt loam, 9 to 14 percent slopes, moderately eroded	19,955	4.9
162E2	Downs silt loam, 14 to 18 percent slopes, moderately eroded	22,785	5.6
163B	Fayette silt loam, 2 to 5 percent slopes	870	0.2
163C	Fayette silt loam, 5 to 9 percent slopes	4,245	1.1
163C2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	21,025	5.2
163D	Fayette silt loam, 9 to 14 percent slopes	8,660	2.2
163D2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	48,038	12.0
163D3	Fayette silty clay loam, 9 to 14 percent slopes, severely eroded	1,525	0.4
163E	Fayette silt loam, 14 to 18 percent slopes	3,160	0.8
163E2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	7,095	1.8
163E3	Fayette silty clay loam, 14 to 18 percent slopes, severely eroded	610	0.2
163F	Fayette silt loam, 18 to 25 percent slopes	5,640	1.4
163F2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	3,975	1.0
163F3	Fayette silty clay loam, 18 to 25 percent slopes, severely eroded	520	0.1
163G	Fayette silt loam, 25 to 40 percent slopes	2,135	0.5
171B	Bassett loam, 2 to 5 percent slopes	875	0.2
171C	Bassett loam, 5 to 9 percent slopes	1,645	0.4
171C2	Bassett loam, 5 to 9 percent slopes, moderately eroded	285	0.1
171D	Bassett loam, 9 to 14 percent slopes	310	0.1
171D2	Bassett loam, 9 to 14 percent slopes, moderately eroded	235	0.1
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	685	0.2
175C	Dickinson fine sandy loam, 5 to 12 percent slopes	930	0.2
183D	Dubuque silt loam, 20 to 30 inches to limestone, 9 to 14 percent slopes	1,080	0.3
183D2	Dubuque silt loam, 20 to 30 inches to limestone, 9 to 14 percent slopes, moderately eroded	1,715	0.4
183E	Dubuque silt loam, 20 to 30 inches to limestone, 14 to 18 percent slopes	1,780	0.4
183E2	Dubuque silt loam, 20 to 30 inches to limestone, 14 to 18 percent slopes, moderately eroded	2,455	0.6
198B	Floyd loam, 1 to 4 percent slopes	1,355	0.3
249B	Zwingle silt loam, 2 to 7 percent slopes	320	0.1
284B	Flagler sandy loam, 2 to 5 percent slopes	300	0.1
285D	Burkhardt sandy loam, 5 to 14 percent slopes	210	0.1
291	Atterberry silt loam, 1 to 3 percent slopes	525	0.1
315	Udifluvents, loamy, 0 to 2 percent slopes	2,115	0.5
320	Arenzville silt loam, 0 to 2 percent slopes	4,800	1.2
391B	Clyde-Floyd loams, 1 to 4 percent slopes	2,900	0.7
394B	Ostrander loam, 2 to 5 percent slopes	1,860	0.5
394C	Ostrander loam, 5 to 9 percent slopes	575	0.1
407B	Schley loam, 1 to 4 percent slopes	1,775	0.4
408B	Olin fine sandy loam, 2 to 5 percent slopes	300	0.1
408C	Olin fine sandy loam, 5 to 9 percent slopes	1,070	0.3
412C	Sogn loam, 2 to 9 percent slopes	1,525	0.4
412D	Sogn loam, 9 to 18 percent slopes	2,595	0.7
428B	Ely silt loam, 2 to 5 percent slopes	415	0.1

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
462B	Downs silt loam, benches, 2 to 7 percent slopes	410	0.1
478G	Nordness-Rock outcrop complex, 18 to 60 percent slopes	20,560	5.1
480C	Orwood silt loam, 5 to 9 percent slopes	1,090	0.3
480C2	Orwood silt loam, 5 to 9 percent slopes, moderately eroded	800	0.2
480D	Orwood silt loam, 9 to 14 percent slopes	560	0.1
480D2	Orwood silt loam, 9 to 14 percent slopes, moderately eroded	4,060	1.0
480F2	Orwood silt loam, 14 to 25 percent slopes, moderately eroded	1,885	0.5
482B	Racine loam, 2 to 5 percent slopes	1,125	0.3
482C	Racine loam, 5 to 9 percent slopes	1,470	0.4
482C2	Racine loam, 5 to 9 percent slopes, moderately eroded	360	0.1
482D2	Racine loam, 9 to 14 percent slopes, moderately eroded	640	0.2
482F2	Racine loam, 14 to 25 percent slopes, moderately eroded	205	0.1
485	Spillville loam, 0 to 2 percent slopes	340	0.1
487B	Otter-Worthen silt loams, 2 to 5 percent slopes	3,065	0.8
488C2	Newvienna silt loam, 5 to 9 percent slopes, moderately eroded	1,480	0.4
488D2	Newvienna silt loam, 9 to 14 percent slopes, moderately eroded	5,840	1.5
490	Caneek silt loam, 0 to 2 percent slopes	735	0.2
496B	Dorchester-Volney complex, 2 to 5 percent slopes	3,330	0.8
497F	Fayette-Dubuque-Schapville complex, 18 to 30 percent slopes	1,540	0.4
499D	Nordness silt loam, 9 to 18 percent slopes	5,700	1.4
499F	Nordness silt loam, 18 to 35 percent slopes	14,500	3.6
512D	Marlean sandy loam, 5 to 14 percent slopes	340	0.1
520	Coppock silt loam, 0 to 2 percent slopes	1,460	0.4
563D	Rozetta-Eleroy silt loams, 9 to 14 percent slopes	1,285	0.3
563D2	Rozetta-Eleroy silt loams, 9 to 14 percent slopes, moderately eroded	11,810	3.0
563E	Rozetta-Eleroy silt loams, 14 to 18 percent slopes	1,980	0.5
563E2	Rozetta-Eleroy silt loams, 14 to 18 percent slopes, moderately eroded	8,805	2.2
589+	Otter silt loam, overwash, 0 to 2 percent slopes	2,040	0.5
663D2	Seaton silt loam, 9 to 14 percent slopes, moderately eroded	430	0.1
663F	Seaton silt loam, 18 to 25 percent slopes	570	0.1
712E	Schapville silt loam, 9 to 18 percent slopes	475	0.1
712F	Schapville silt loam, 18 to 30 percent slopes	5,680	1.4
714C	Winneshiek loam, 20 to 30 inches to limestone, 3 to 9 percent slopes	755	0.2
726	Hayfield loam, 32 to 40 inches to sand and gravel, 0 to 3 percent slopes	845	0.2
763E2	Exette silt loam, 14 to 18 percent slopes, moderately eroded	3,835	1.0
763F2	Exette silt loam, 18 to 25 percent slopes, moderately eroded	1,605	0.4
777B	Wapsie loam, 2 to 7 percent slopes	1,430	0.4
814B	Rockton loam, 2 to 5 percent slopes	620	0.2
814C	Rockton loam, 5 to 9 percent slopes	660	0.2
915C	Rollingstone silt loam, 5 to 9 percent slopes	275	0.1
915C2	Rollingstone silt loam, 5 to 9 percent slopes, moderately eroded	260	0.1
915D2	Rollingstone silt loam, 9 to 14 percent slopes, moderately eroded	1,155	0.3
930B	Orion silt loam, 1 to 4 percent slopes	3,765	0.9
951F	Medary silt loam, 18 to 30 percent slopes	285	0.1
964F	Fayette-Rock outcrop complex, 14 to 25 percent slopes	325	0.1
978B	Festina silt loam, 1 to 5 percent slopes	650	0.2
981B	Worthen silt loam, 2 to 5 percent slopes	1,135	0.3
1490	Caneek silt loam, channeled, 0 to 2 percent slopes	510	0.1
4110B	Urban land-Lamont complex, 2 to 7 percent slopes	365	0.1
4158B	Urban land-Dorchester complex, 2 to 5 percent slopes	335	0.1
4163C	Fayette-Urban land complex, 5 to 9 percent slopes	770	0.2
4163D	Fayette-Urban land complex, 9 to 14 percent slopes	1,610	0.4
4163E	Fayette-Urban land complex, 14 to 20 percent slopes	315	0.1
5030	Pits, quarries	270	0.1
5040B	Orthents, loamy, 0 to 5 percent slopes	1,760	0.4
5040D	Orthents, loamy, 5 to 14 percent slopes	700	0.2
5070	Psamments-Urban land complex, 0 to 2 percent slopes	995	0.2
	Water	6,272	1.6
	Total	398,080	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
27B	Terril loam, 2 to 5 percent slopes
83B	Kenyon loam, 2 to 5 percent slopes
84	Clyde loam, 0 to 2 percent slopes (where drained)
97	Lawson-Huntsville silt loams, 0 to 2 percent slopes
119	Muscatine silt loam, 1 to 3 percent slopes
120B	Tama silt loam, 2 to 5 percent slopes
142	Chaseburg silt loam, 0 to 2 percent slopes
152	Marshan loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes (where drained)
158	Dorchester silt loam, 0 to 2 percent slopes
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
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
198B	Floyd loam, 1 to 4 percent slopes
291	Atterberry silt loam, 1 to 3 percent slopes (where drained)
320	Arenzville silt loam, 0 to 2 percent slopes
391B	Clyde-Floyd loams, 1 to 4 percent slopes (where drained)
394B	Ostrander loam, 2 to 5 percent slopes
407B	Schley loam, 1 to 4 percent slopes (where drained)
408B	Olin fine sandy loam, 2 to 5 percent slopes
428B	Ely silt loam, 2 to 5 percent slopes
462B	Downs silt loam, benches, 2 to 7 percent slopes
482B	Racine loam, 2 to 5 percent slopes
485	Spillville loam, 0 to 2 percent slopes
520	Coppock silt loam, 0 to 2 percent slopes (where drained)
726	Hayfield loam, 32 to 40 inches to sand and gravel, 0 to 3 percent slopes (where drained)
777B	Wapsie loam, 2 to 7 percent slopes
814B	Rockton loam, 2 to 5 percent slopes
978B	Festina silt loam, 1 to 5 percent slopes
981B	Worthen silt loam, 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	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
27B------------- Terril	IIe	118	45	94	5.0	7.0	4.2	8.3
41C------------- Sparta	IVs	56	21	42	2.3	3.4	2.0	3.8
63C------------- Chelsea	IVs	52	20	39	1.8	3.0	1.8	3.0
63D------------- Chelsea	VIs	---	---	35	1.5	2.5	1.5	2.5
63F------------- Chelsea	VIIs	---	---	---	1.0	1.6	1.0	1.6
65E2------------ Lindley	VIe	---	---	---	1.5	2.3	2.0	2.5
65F------------- Lindley	VIIe	---	---	---	1.0	1.6	1.6	1.8
83B------------- Kenyon	IIe	113	43	90	4.7	6.6	4.2	7.8
83C------------- Kenyon	IIIe	108	41	86	4.5	6.5	4.0	7.5
84-------------- Clyde	IIw	102	39	82	4.0	5.5	6.6	6.6
97-------------- Lawson-Huntsville	IIw	110	24	91	5.1	7.2	4.1	8.4
109C------------ Backbone	IVs	50	19	35	2.1	3.0	2.0	3.5
109D------------ Backbone	VIs	---	---	---	1.8	2.2	1.6	3.0
110B------------ Lamont	IIIe	69	26	52	2.5	3.5	2.3	4.1
110C------------ Lamont	IIIe	64	24	48	2.3	3.3	2.1	3.8
110D------------ Lamont	IVe	55	21	41	1.8	2.5	1.8	3.0
119------------- Muscatine	I	129	49	96	5.5	7.6	4.2	9.1
120B------------ Tama	IIe	125	48	95	5.2	7.5	4.2	8.6
120C------------ Tama	IIIe	120	46	90	5.0	7.1	4.0	8.3
120C2----------- Tama	IIIe	117	44	88	4.9	7.0	3.8	8.1
129B------------ Chaseburg-Arenzville	IIe	113	40	83	4.7	5.7	4.2	6.6

See footnote 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	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
142------------- Chaseburg	IIw	130	45	80	5.5	6.3	5.0	6.8
152------------- Marshan	IIw	95	35	70	4.0	5.5	3.6	6.0
158------------- Dorchester	IIw	95	38	80	4.0	5.6	3.8	6.6
162B------------ Downs	IIe	119	45	95	5.0	7.1	4.1	8.3
162C------------ Downs	IIIe	114	43	91	4.8	6.8	4.0	8.1
162C2----------- Downs	IIIe	111	42	89	4.7	6.6	3.8	7.8
162D------------ Downs	IIIe	105	40	84	4.4	6.3	3.8	7.3
162D2----------- Downs	IIIe	102	39	82	4.3	6.1	3.6	7.1
162E2----------- Downs	IVe	87	33	69	3.7	5.1	3.5	6.1
163B------------ Fayette	IIe	113	43	90	4.7	6.6	4.0	7.8
163C------------ Fayette	IIIe	108	41	86	4.5	6.5	3.8	7.5
163C2----------- Fayette	IIIe	105	40	84	4.4	6.5	3.6	7.5
163D------------ Fayette	IIIe	99	38	80	4.2	6.0	3.6	7.0
163D2----------- Fayette	IIIe	96	36	76	4.0	5.8	3.5	6.6
163D3----------- Fayette	IVe	90	32	72	---	4.2	2.5	4.6
163E------------ Fayette	IVe	84	32	67	3.5	5.0	3.3	5.8
163E2----------- Fayette	IVe	81	31	65	3.4	4.8	3.2	5.6
163E3----------- Fayette	VIe	---	---	60	3.0	4.2	2.5	4.6
163F------------ Fayette	VIe	---	---	---	3.4	4.8	3.1	5.6
163F2----------- Fayette	VIe	---	---	---	3.2	4.5	2.8	5.0
163F3----------- Fayette	VIe	---	---	---	---	4.2	2.5	4.6
163G------------ Fayette	VIIe	---	---	---	---	4.2	3.0	5.0
171B------------ Bassett	IIe	107	40	85	4.5	6.5	4.0	7.5

See footnote 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	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
171C------------ Bassett	IIIe	102	39	81	4.3	6.1	4.0	7.1
171C2----------- Bassett	IIIe	99	38	80	4.0	6.0	3.5	6.6
171D------------ Bassett	IIIe	93	35	74	4.0	5.6	3.5	6.6
171D2----------- Bassett	IIIe	90	34	72	3.8	5.3	3.2	6.3
175B------------ Dickinson	IIe	81	31	60	3.0	4.8	2.7	5.0
175C------------ Dickinson	IIIe	76	29	57	2.8	4.5	2.5	4.6
183D------------ Dubuque	IVe	59	25	47	2.5	3.5	2.0	4.1
183D2----------- Dubuque	IVe	56	21	45	2.3	3.3	1.8	3.8
183E------------ Dubuque	VIe	---	---	40	2.1	3.0	1.6	3.5
183E2----------- Dubuque	VIe	---	---	38	1.9	2.8	1.4	3.1
198B------------ Floyd	IIw	106	40	85	4.5	6.9	4.1	7.5
249B------------ Zwingle	IIIe	60	23	45	2.4	3.5	2.5	4.0
284B------------ Flagler	IIIe	70	26	56	2.9	4.1	2.1	4.8
285D------------ Burkhardt	VIs	55	18	45	2.5	0.9	1.0	0.8
291------------- Atterberry	I	148	44	84	5.5	6.3	5.0	6.8
315. Udifluvents	Vw							
320------------- Arenzville	IIw	120	40	80	5.0	6.4	5.0	7.5
391B------------ Clyde-Floyd	IIw	103	39	83	4.2	6.1	5.6	7.0
394B------------ Ostrander	IIe	105	33	75	4.5	6.8	3.5	6.7
394C------------ Ostrander	IIIe	95	30	70	4.3	6.5	3.3	6.3
407B------------ Schley	IIw	100	38	80	4.2	6.0	4.0	7.0
408B------------ Olin	IIe	97	37	73	4.1	5.8	3.0	6.8
408C------------ Olin	IIIe	92	35	70	3.9	5.5	2.8	6.5

See footnote 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	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
412C, 412D------ Sogn	VIIs	---	---	23	1.2	1.7	1.1	2.1
428B------------ Ely	IIe	124	47	93	5.3	7.5	4.0	8.8
462B------------ Downs	IIe	119	45	95	5.0	7.1	4.1	8.3
478G------------ Nordness-Rock outcrop	VIIs	---	---	---	---	---	---	---
480C------------ Orwood	IIIe	100	38	80	4.2	6.0	3.7	7.0
480C2----------- Orwood	IIIe	96	36	77	4.0	5.6	3.6	6.6
480D------------ Orwood	IIIe	89	34	71	3.7	5.3	3.4	6.1
480D2----------- Orwood	IIIe	86	33	69	3.6	5.1	3.4	6.0
480F2----------- Orwood	VIe	---	---	---	2.6	3.6	2.9	4.5
482B------------ Racine	IIe	107	40	85	4.5	6.4	4.0	7.5
482C------------ Racine	IIIe	102	39	81	4.3	6.1	3.8	7.1
482C2----------- Racine	IIIe	90	34	72	3.8	5.4	3.0	6.3
482D2----------- Racine	IVe	82	30	64	3.4	4.9	3.1	5.7
482F2----------- Racine	VIe	---	---	---	4.0	3.8	2.5	6.0
485------------- Spillville	IIw	122	46	98	5.1	7.3	4.2	8.6
487B------------ Otter-Worthen	IIIw	102	39	76	4.0	6.1	2.1	6.6
488C2----------- Newvienna	IIIe	103	35	85	4.6	6.6	3.7	7.7
488D2----------- Newvienna	IIIe	94	30	68	4.2	6.0	3.5	7.0
490------------- Caneek	IIIw	80	30	65	3.9	5.8	3.6	6.9
496B------------ Dorchester-Volney	VIs	---	---	---	3.5	4.4	3.0	5.9
497F------------ Fayette-Dubuque-Schapville	VIIe	---	---	---	2.1	3.0	1.6	3.5
499D------------ Nordness	VIs	---	---	---	1.2	1.2	1.0	2.0

See footnote 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	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
499F------------ Nordness	VIIs	---	---	---	0.4	0.7	0.5	0.7
512D------------ Marlean	VIe	---	---	36	2.0	2.7	1.5	3.3
520------------- Coppock	IIw	89	34	49	3.7	4.7	3.3	6.1
563D------------ Rozetta-Eleroy	IIIe	87	33	67	3.6	5.2	3.4	6.0
563D2----------- Rozetta-Eleroy	IIIe	84	32	65	3.5	5.0	3.3	5.8
563E------------ Rozetta-Eleroy	IVe	73	30	54	3.1	4.3	2.9	5.1
563E2----------- Rozetta-Eleroy	IVe	70	20	52	3.0	4.1	2.8	4.9
589+------------ Otter	IIw	143	46	69	4.7	7.2	4.1	8.3
663D2----------- Seaton	IIIe	110	33	64	4.0	5.8	3.6	6.6
663F------------ Seaton	VIe	---	---	---	3.6	4.9	3.1	5.6
712E------------ Schapville	VIe	---	---	---	3.3	3.6	2.2	4.0
712F------------ Schapville	VIIe	---	---	---	1.3	1.7	1.1	1.9
714C------------ Winneshiek	IIIe	65	25	52	2.7	3.8	2.5	4.5
726------------- Hayfield	IIs	94	36	75	4.0	5.6	4.2	6.6
763E2----------- Exette	IVe	75	28	60	3.2	4.5	2.5	5.3
763F2----------- Exette	VIe	---	---	50	2.8	2.9	2.0	4.6
777B------------ Wapsie	IIe	70	27	56	2.9	4.1	2.6	4.8
814B------------ Rockton	IIe	76	29	60	3.0	---	2.6	5.0
814C------------ Rockton	IIIe	71	27	57	2.8	---	2.5	4.6
915C------------ Rollingstone	IIIe	60	23	48	2.5	3.7	2.3	4.1
915C2----------- Rollingstone	IIIe	53	20	42	2.2	3.2	1.7	3.6
915D2----------- Rollingstone	IVe	48	18	24	1.8	2.6	0.9	3.0
930B------------ Orion	IIIw	90	26	76	3.9	5.4	3.3	6.6
951F------------ Medary	VIIe	---	---	---	1.2	1.6	1.2	2.2

See footnote 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	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
964F------------ Fayette-Rock outcrop	VIIe	---	---	---	3.0	4.3	2.5	4.6
978B------------ Festina	IIe	114	43	91	4.8	6.8	3.6	8.0
981B------------ Worthen	IIe	120	46	95	5.2	7.0	4.0	8.4
1490------------ Caneek	Vw	---	---	---	---	---	3.5	---
4110B----------- Urban land-Lamont	---	---	---	---	---	---	---	---
4158B----------- Urban land-Dorchester	---	---	---	---	---	---	---	---
4163C----------- Fayette-Urban land	---	---	---	---	---	---	---	---
4163D----------- Fayette-Urban land	---	---	---	---	---	---	---	---
4163E----------- Fayette-Urban land	---	---	---	---	---	---	---	---
5030. Pits								
5040B, 5040D. Orthents								
5070------------ Psamments-Urban land	---	---	---	---	---	---	---	---

* 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.

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	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	Trees to plant
41C----------------- Sparta	6s	Slight	Slight	Severe	Slight	Jack pine----------- Northern red oak---- Red pine------------	57 47 ---	Red pine, eastern white pine, jack pine.
63C, 63D----------- Chelsea	4s	Slight	Slight	Moderate	Slight	White oak----------- Red pine------------ Eastern white pine-- Jack pine----------- Quaking aspen------- Northern red oak----	70 72 83 70 72 70	Eastern white pine, red pine, jack pine, white oak.
63F----------------- Chelsea	4r	Moderate	Severe	Moderate	Slight	White oak----------- Red pine------------ Eastern white pine-- Jack pine----------- Quaking aspen------- Northern red oak----	70 72 83 70 72 70	Eastern white pine, red pine, jack pine, white oak.
65E2, 65F---------- Lindley	2r	Moderate	Moderate	Moderate	Slight	Blackjack oak------- Black oak-----------	50 ---	White oak, green ash, yellow-poplar, black oak.
97*:								
Lawson------------	2a	Slight	Slight	Slight	Slight	Silver maple-------- White ash----------- American elm--------	70 --- ---	Silver maple, white ash.
Huntsville--------	7a	Slight	Slight	Slight	Slight	Yellow-poplar------- Eastern cottonwood-- American sycamore--- Cherrybark oak------ Sweetgum------------ Green ash-----------	98 110 --- --- --- ---	Eastern cottonwood, black walnut, American sycamore, red maple, sugar maple, green ash, hackberry.
109C, 109D--------- Backbone	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine, red pine, black walnut, sugar maple.
110B, 110C, 110D--- Lamont	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine.
129B*:								
Chaseburg---------	3a	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- American basswood---	65 --- ---	Red pine, eastern white pine, sugar maple, black walnut, northern red oak.
Arenzville--------	3a	Slight	Slight	Slight	Slight	Northern red oak---- Bur oak------------- Silver maple--------	65 --- ---	Red pine, eastern white pine, northern red oak, black walnut.
142---------------- Chaseburg	3a	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- American basswood---	65 --- ---	Red pine, eastern white pine, sugar maple, black walnut, northern red oak.
158---------------- Dorchester	3a	Slight	Slight	Moderate	Slight	White oak----------- Northern red oak----	55 55	White oak, hackberry, green ash, cottonwood.

See footnote 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	Trees to plant
162B, 162C, 162C2, 162D, 162D2: Downs	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, sugar maple.
162E2: Downs	3a	Moderate	Moderate	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, sugar maple.
163B, 163C, 163C2, 163D, 163D2, 163D3: Fayette	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, sugar maple.
163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G: Fayette	3a	Moderate	Moderate	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, sugar maple.
171B, 171C, 171C2, 171D, 171D2: Bassett	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, black walnut, sugar maple.
183D, 183D2: Dubuque	3a	Slight	Slight	Slight	Slight	Northern red oak White oak	65 65	Eastern white pine, red pine, black walnut.
183E, 183E2: Dubuque	3a	Moderate	Moderate	Slight	Slight	Northern red oak White oak	65 65	Eastern white pine, red pine, black walnut.
249B: Zwingle	2w	Slight	Severe	Moderate	Moderate	Silver maple Eastern cottonwood	80 90	Eastern cottonwood.
285D: Burkhardt	2a	Slight	Slight	Slight	Slight	Northern pin oak Black oak Jack pine	52 --- ---	Eastern white pine, red pine, jack pine.
291: Atterberry	3a	Slight	Slight	Slight	Slight	Northern red oak White oak Silver maple White ash Green ash	65 65 90 65 65	Eastern white pine, red pine, silver maple, green ash.
320: Arenzville	3a	Slight	Slight	Slight	Slight	Northern red oak Bur oak Silver maple	65 --- ---	Red pine, eastern white pine, northern red oak, black walnut.
407B: Schley	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, black walnut, sugar maple.
462B: Downs	3a	Slight	Slight	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, black walnut, sugar maple.
478G*:								
Nordness	2d	Moderate	Moderate	Severe	Slight	Northern red oak White oak	45 45	
Rock outcrop.								

See footnote 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	Trees to plant
480C, 480C2, 480D, 480D2------------- Orwood	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.
480F2-------------- Orwood	3a	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.
482B, 482C, 482C2, 482D2------------- Racine	3a	Slight	Slight	Slight	Slight	American basswood--- Northern red oak---- Black walnut-------- Sugar maple---------	68 65 60 60	Eastern white pine, black walnut, green ash, northern red oak.
482F2-------------- Racine	3r	Moderate	Moderate	Slight	Slight	American basswood--- Northern red oak---- Black walnut-------- Sugar maple---------	68 65 60 60	White spruce, eastern white pine, black walnut, green ash.
488C2, 488D2------- Newvienna	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple, white oak, northern red oak.
496B*:								
Dorchester--------	3a	Slight	Slight	Moderate	Slight	White oak----------- Northern red oak----	55 55	Hackberry, green ash, cottonwood.
Volney------------	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine, red pine, black walnut, sugar maple.
497F*:								
Fayette-----------	3r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.
Dubuque-----------	3r	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak-----------	65 65	Eastern white pine, red pine, black walnut.
Schapville.								
499D, 499F--------- Nordness	2d	Moderate	Moderate	Severe	Slight	Northern red oak---- White oak-----------	45 45	
520---------------- Coppock	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, sugar maple.
563D*, 563D2*:								
Rozetta-----------	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Bur oak------------- Shagbark hickory----	65 --- --- ---	Eastern white pine, northern red oak, red pine, black walnut.
Eleroy------------	4a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	70 ---	Eastern white pine, red pine, northern red oak, white oak.

See footnote 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	Trees to plant
563E*, 563E2*:								
Rozetta-----------	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Bur oak------------- Shagbark hickory----	65 --- --- ---	Eastern white pine, northern red oak, red pine, black walnut.
Eleroy------------	4r	--------	--------	--------	--------	White oak----------- Northern red oak----	70 ---	Eastern white pine, red pine, northern red oak, white oak.
663D2-------------- Seaton	4a	Slight	Slight	Slight	Slight	Northern red oak----	70	Black walnut, red pine, northern red oak.
663F--------------- Seaton	4r	Moderate	Moderate	Moderate	Slight	Northern red oak----	70	Black walnut, red pine, northern red oak.
714C--------------- Winneshiek	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	65 65	Eastern white pine, red pine, black walnut.
726---------------- Hayfield	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Eastern white pine--	63 63 58	Northern red oak, white oak, silver maple, eastern white pine, black walnut, red pine, white ash.
763E2, 763F2------- Exette	4r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak---- Black walnut-------- Green ash----------- Sugar maple--------- American basswood--- Black cherry--------	80 80 --- --- --- --- ---	Eastern white pine, red pine, white oak, northern red oak, green ash, black walnut.
777B--------------- Wapsie	3a	Slight	Slight	Slight	Slight	Northern red oak---- White oak-----------	55 55	Eastern white pine, red pine, black walnut, sugar maple.
915C, 915C2, 915D2- Rollingstone	3c	Slight	Slight	Slight	Moderate	Northern red oak---- White oak----------- Shagbark hickory---- American basswood--- Sugar maple---------	60 55 55 55 50	Northern red oak, American basswood, sugar maple, eastern white pine.
930B--------------- Orion	2a	Slight	Slight	Slight	Slight	Silver maple-------- Red maple----------- White ash-----------	80 --- ---	Silver maple, white ash, eastern cottonwood.
951F--------------- Medary	3r	Moderate	Moderate	Severe	Severe	Northern red oak---- Sugar maple--------- American basswood---	65 --- ---	Eastern white pine, red pine.
964F*:								
Fayette-----------	3r	Moderate	Moderate	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.
Rock outcrop.								
978B--------------- Festina	3a	Slight	Slight	Slight	Slight	White oak----------- Northern red oak----	65 65	Eastern white pine, red pine, black walnut, sugar maple.

* 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
27B---------------- Terril	---	Gray dogwood, Siberian peashrub, redosier dogwood, lilac.	Honeylocust, Russian-olive, Amur maple, blue spruce, northern white-cedar, eastern redcedar.	Eastern white pine, green ash.	---
41C---------------- Sparta	Siberian peashrub	Eastern redcedar, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine, honeylocust, green ash, Russian-olive, Siberian elm.	Eastern white pine	---
63C, 63D, 63F----- Chelsea	Siberian peashrub, lilac.	Eastern redcedar, Tatarian honeysuckle.	Red pine, jack pine, Austrian pine.	Eastern white pine	---
65E2, 65F--------- Lindley	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern white-cedar, eastern redcedar, Amur maple, blue spruce, hackberry, Russian-olive.	Green ash, eastern white pine.	---
83B, 83C---------- Kenyon	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern white-cedar, hackberry, blue spruce, eastern redcedar, Russian-olive, Amur maple.	Eastern white pine, green ash.	---
84---------------- Clyde	---	Redosier dogwood, American plum, Tatarian honeysuckle.	Hackberry, Amur maple, northern white-cedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
97*:					
Lawson-----------	---	Redosier dogwood, Siberian peashrub, lilac, gray dogwood.	Hackberry, eastern redcedar, northern white-cedar, Russian-olive, blue spruce, Amur maple.	Eastern white pine, green ash.	---
Huntsville-------	---	Lilac, redosier dogwood, Tatarian honeysuckle.	Northern white-cedar, blue spruce, Amur maple, white spruce.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
109C, 109D-------- Backbone	Lilac, Tatarian honeysuckle.	Eastern redcedar, Siberian peashrub.	Russian-olive, eastern white pine, Manchurian crabapple, green ash, 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
110B, 110C, 110D-- Lamont	Lilac	Eastern redcedar, Tatarian honeysuckle, Russian-olive, Siberian peashrub.	Eastern white pine, Norway spruce, hackberry, Amur maple, red pine, honeylocust, green ash.	---	---
119 Muscatine	---	Tatarian honeysuckle, redosier dogwood, lilac.	Blue spruce, northern white-cedar, white spruce, Amur maple.	Austrian pine, eastern white pine, hackberry, green ash.	Silver maple.
120B, 120C, 120C2- Tama	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Northern white-cedar, eastern redcedar, Amur maple, blue spruce, hackberry, Russian-olive.	Green ash, eastern white pine.	---
129B*:					
Chaseburg	---	Lilac, redosier dogwood, Tatarian honeysuckle.	White spruce, blue spruce, northern white-cedar, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
Arenzville	---	Lilac, Tatarian honeysuckle, redosier dogwood.	White spruce, blue spruce, northern white-cedar, Amur maple.	Eastern white pine, Austrian pine, green ash, hackberry.	Silver maple.
142 Chaseburg	---	Lilac, redosier dogwood, Tatarian honeysuckle; silky dogwood.	White spruce, blue spruce, northern white-cedar, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
152 Marshan	---	Redosier dogwood, American plum, Tatarian honeysuckle.	Hackberry, northern white-cedar, Amur maple, white spruce, tall purple willow.	Golden willow, green ash.	Silver maple, eastern cottonwood.
158 Dorchester	---	Northern white-cedar, Siberian peashrub, Tatarian honeysuckle, lilac; silky dogwood.	Hackberry, bur oak, eastern redcedar, white spruce.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
162B, 162C, 162C2, 162D, 162D2, 162E2 Downs	---	Siberian peashrub, gray dogwood, Tatarian honeysuckle, lilac, silky dogwood.	Northern white-cedar, hackberry, blue spruce, Russian-olive, eastern redcedar, Amur maple.	Eastern white pine, 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
163B, 163C, 163C2, 163D, 163D2, 163D3, 163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G------ Fayette	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, Russian-olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
171B, 171C, 171C2, 171D, 171D2------ Bassett	---	Redosier dogwood, gray dogwood, Siberian peashrub, lilac.	Russian-olive, eastern redcedar, northern white-cedar, blue spruce, Amur maple, hackberry.	Green ash, eastern white pine.	---
175B, 175C-------- Dickinson	Lilac, Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar, Manchurian crabapple, hackberry.	Eastern white pine, green ash, honeylocust, jack pine, bur oak, Russian-olive.	---	---
183D, 183D2, 183E, 183E2------------ Dubuque	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub.	Hackberry, Russian-olive, Manchurian crabapple, jack pine, eastern white pine, green ash.	Siberian elm, honeylocust.	---
198B-------------- Floyd	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Blue spruce, Amur maple, northern white-cedar, white spruce.	Austrian pine, hackberry, green ash, eastern white pine.	Silver maple.
249B-------------- Zwingle	---	American plum, redosier dogwood, Tatarian honeysuckle.	Amur maple, northern white-cedar, hackberry, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
284B-------------- Flagler	Tatarian honeysuckle, Siberian peashrub, lilac.	Manchurian crabapple, hackberry, eastern redcedar.	Honeylocust, eastern white pine, jack pine, green ash, Russian-olive, bur oak.	---	---
285D-------------- Burkhardt	Siberian peashrub, lilac, Tatarian honeysuckle.	Hackberry, Manchurian crabapple, eastern redcedar.	Eastern white pine, honeylocust, jack pine, bur oak, Russian-olive, green ash.	---	---
291--------------- Atterberry	---	Tatarian honeysuckle, redosier dogwood, lilac.	White spruce, blue spruce, northern white-cedar, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
315*. Udifluvents					

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
320. Arenzville	---	Lilac, Tatarian honeysuckle, redosier dogwood.	White spruce, blue spruce, northern white-cedar, Amur maple.	Eastern white pine, Austrian pine, green ash, hackberry.	Silver maple.
391B*:					
Clyde	---	Redosier dogwood, American plum, Tatarian honeysuckle.	Hackberry, Amur maple, northern white-cedar, tall purple willow, white spruce.	Golden willow, green ash.	Eastern cottonwood, silver maple.
Floyd	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Blue spruce, Amur maple, northern white-cedar, 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 white-cedar.	Eastern white pine, green ash.	---
407B. Schley	---	Redosier dogwood, lilac, Tatarian honeysuckle.	Northern white-cedar, blue spruce, white spruce, Amur maple.	Green ash, Austrian pine, eastern white pine, hackberry.	Silver maple.
408B, 408C. Olin	Lilac.	Russian-olive, eastern redcedar, Tatarian honeysuckle, Siberian peashrub.	Red pine, green ash, Norway spruce, eastern white pine, Amur maple, hackberry, honeylocust.	---	---
412C, 412D. Sogn					
428B. Ely	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce.	Eastern white pine, pin oak.
462B. Downs	---	Siberian peashrub, gray dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, hackberry, blue spruce, Russian-olive, eastern redcedar, Amur maple.	Eastern white pine, green ash.	---
478G*:					
Nordness.					
Rock outcrop.					
480C, 480C2, 480D, 480D2, 480F2. Orwood	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Eastern redcedar, Russian-olive, northern white-cedar, blue spruce, Amur maple, hackberry.	Eastern white pine, 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
482B, 482C, 482C2, 482D2, 482F2----- Racine	---	Gray dogwood, Siberian peashrub, redosier dogwood, lilac.	Eastern redcedar, northern white-cedar, blue spruce, hackberry, Amur maple, Russian-olive.	Eastern white pine, green ash.	---
485---------------- Spillville	---	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, blue spruce, Amur maple.	Hackberry, eastern white pine, Austrian pine, green ash.	Silver maple.
487B*:					
Otter-------------	---	American plum, American cranberrybush, redosier dogwood, northern white-cedar, common ninebark, nannyberry viburnum.	Amur maple, white spruce, hackberry.	Green ash---------	Silver maple, eastern cottonwood.
Worthen-----------	---	Siberian peashrub, redosier dogwood, gray dogwood, lilac.	Eastern redcedar, northern white-cedar, Amur maple, blue spruce, hackberry, Russian-olive.	Green ash, eastern white pine.	---
488C2, 488D2------ Newvienna	---	Northern white-cedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	Norway spruce-----	Red pine, white ash, red maple, white spruce.	Eastern white pine.
490---------------- Caneek	---	Lilac, Siberian peashrub, northern white-cedar, Tatarian honeysuckle.	Hackberry, white spruce, eastern redcedar, bur oak.	Honeylocust, green ash, golden willow.	Eastern cottonwood.
496B*:					
Dorchester--------	---	Northern white-cedar, Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, bur oak, eastern redcedar, white spruce.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
Volney.					
497F*:					
Fayette-----------	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, Russian-olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, 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
497F*:					
Dubuque	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub.	Hackberry, Russian-olive, Manchurian crabapple, jack pine, eastern white pine, green ash.	Siberian elm, honeylocust.	---
Schapville	---	Eastern redcedar, northern white-cedar, Siberian peashrub, lilac.	Hackberry, white spruce, Russian-olive.	White ash, red pine, red maple, eastern white pine, green ash.	---
499D, 499F. Nordness					
512D Marlean	Siberian peashrub, Tatarian honeysuckle, lilac.	Eastern redcedar, Manchurian crabapple, hackberry.	Eastern white pine, jack pine, green ash, honeylocust, Russian-olive, bur oak.	---	---
520 Coppock	---	Lilac, redosier dogwood, Tatarian honeysuckle.	White spruce, northern white-cedar, blue spruce, Amur maple.	Austrian pine, eastern white pine, green ash, hackberry.	Silver maple.
563D*, 563D2*, 563E*, 563E2*:					
Rozetta	---	Northern white-cedar, Peking cotoneaster, gray dogwood, silky dogwood, lilac, Amur maple.	White spruce	Eastern white pine, red pine, white ash.	---
Eleroy	---	Gray dogwood, redosier dogwood, lilac, Siberian peashrub, northern white-cedar.	Eastern redcedar, Amur maple, hackberry, Russian-olive.	Red pine, green ash, eastern white pine.	---
589+ Otter	---	American plum, American cranberrybush, redosier dogwood, northern white-cedar, common ninebark, nannyberry viburnum.	Amur maple, white spruce, hackberry.	Green ash	Silver maple, eastern cottonwood.
663D2, 663F Seaton	---	Gray dogwood, redosier dogwood, lilac, Siberian peashrub.	Hackberry, northern white-cedar, Russian-olive, eastern redcedar, Amur maple, blue spruce.	Eastern white pine, green ash.	---
712E, 712F Schapville	---	Eastern redcedar, northern white-cedar, Siberian peashrub, lilac.	Hackberry, white spruce, Russian-olive.	White ash, red pine, red maple, eastern white pine, 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
714C: Winneshiek	Lilac, Tatarian honeysuckle.	Eastern redcedar, Siberian peashrub.	Russian-olive, eastern white pine, green ash, Manchurian crabapple, jack pine, hackberry.	Siberian elm, honeylocust.	---
726: Hayfield	---	Tatarian honeysuckle, lilac, redosier dogwood.	Blue spruce, northern white-cedar, white spruce, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
763E2, 763F2: Exette	---	Redosier dogwood, lilac, gray dogwood, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, blue spruce, Amur maple, hackberry, Russian-olive.	Green ash, eastern white pine.	---
777B: Wapsie	Lilac, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, hackberry.	Russian-olive, jack pine, green ash, bur oak, eastern white pine, honeylocust.	---	---
814B, 814C: Rockton	Tatarian honeysuckle, lilac.	Eastern redcedar, Siberian peashrub.	Eastern white pine, green ash, hackberry, Manchurian crabapple, Russian-olive, jack pine.	Honeylocust, Siberian elm.	---
915C, 915C2, 915D2: Rollingstone	---	Eastern redcedar, northern white-cedar, Tatarian honeysuckle, Siberian peashrub, lilac.	Hackberry, bur oak, white spruce, Russian-olive, Austrian pine.	Eastern white pine, green ash.	---
930B: Orion	---	Northern white-cedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, white ash, red maple.	---
951F: Medary	---	Lilac, Siberian peashrub, Tatarian honeysuckle, eastern redcedar, northern white-cedar.	Austrian pine, white spruce, hackberry, Russian-olive, bur oak.	Eastern white pine, green ash.	---
964F*:					
Fayette	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, Russian-olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
Rock outcrop.					

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
978B--------------- Festina	---	Redosier dogwood, gray dogwood, lilac, Siberian peashrub.	Eastern redcedar, northern white-cedar, Russian-olive, Amur maple, hackberry, blue spruce.	Green ash, eastern white pine.	---
981B--------------- Worthen	---	Siberian peashrub, redosier dogwood, gray dogwood, lilac.	Eastern redcedar, northern white-cedar, Amur maple, blue spruce, hackberry, Russian-olive.	Green ash, eastern white pine.	---
1490--------------- Caneek	---	Lilac, Siberian peashrub, northern white-cedar, Tatarian honeysuckle.	Hackberry, white spruce, eastern redcedar, bur oak.	Honeylocust, green ash, golden willow.	Eastern cottonwood.
4110B*: Urban land.					
Lamont------------	Lilac--------------	Eastern redcedar, Tatarian honeysuckle, Russian-olive, Siberian peashrub.	Eastern white pine, Norway spruce, hackberry, Amur maple, red pine, honeylocust, green ash.	---	---
4158B*: Urban land.					
Dorchester--------	---	Northern white-cedar, Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, bur oak, eastern redcedar, white spruce.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
4163C*, 4163D*, 4163E*: Fayette----------	---	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern white-cedar, hackberry, Russian-olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
Urban land.					
5030*. Pits					
5040B, 5040D. Orthents					
5070*: Psamments.					
Urban land.					

* 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
27B: Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
41C: Sparta	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
63C: Chelsea	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
63D: Chelsea	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, droughty.
63F: Chelsea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65E2, 65F: Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
83B: Kenyon	Slight	Slight	Moderate: slope.	Slight	Slight.
83C: Kenyon	Slight	Slight	Severe: slope.	Slight	Slight.
84: Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
97*:					
Lawson	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Huntsville	Severe: flooding.	Slight	Slight	Slight	Slight.
109C: Backbone	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Moderate: thin layer.
109D: Backbone	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope, thin layer.
110B: Lamont	Slight	Slight	Moderate: slope.	Slight	Slight.
110C: Lamont	Slight	Slight	Severe: slope.	Slight	Slight.
110D: Lamont	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
119: Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
120B: Tama	Slight	Slight	Moderate: slope.	Slight	Slight.
120C, 120C2: Tama	Slight	Slight	Severe: slope.	Slight	Slight.

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
129B*:					
Chaseburg	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight	Moderate: flooding.
Arenzville	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
142 Chaseburg	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
152 Marshan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
158 Dorchester	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
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.
162E2 Downs	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
163B Fayette	Slight	Slight	Moderate: slope.	Slight	Slight.
163C, 163C2 Fayette	Slight	Slight	Severe: slope.	Slight	Slight.
163D, 163D2, 163D3 Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
163E, 163E2, 163E3, 163F, 163F2, 163F3 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.
175B Dickinson	Slight	Slight	Moderate: slope.	Slight	Slight.
175C Dickinson	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
183D, 183D2 Dubuque	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.

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
183E, 183E2: Dubuque	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
198B: Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
249B: Zwingle	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
284B: Flagler	Slight	Slight	Moderate: slope.	Slight	Slight.
285D: Burkhardt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
291: Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
315*. Udifluvents					
320: Arenzville	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
391B*:					
Clyde	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Floyd	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
394B: Ostrander	Slight	Slight	Moderate: slope.	Slight	Slight.
394C: Ostrander	Slight	Slight	Severe: slope.	Slight	Slight.
407B: Schley	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
408B: Olin	Slight	Slight	Moderate: slope.	Slight	Slight.
408C: Olin	Slight	Slight	Severe: slope.	Slight	Slight.
412C: Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
412D: Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: thin layer.
428B: Ely	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
462B: Downs	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
478G*:					
Nordness	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.	Severe: slope, thin layer.
Rock outcrop.					
480C, 480C2 Orwood	Slight	Slight	Severe: slope.	Slight	Slight.
480D, 480D2 Orwood	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
480F2 Orwood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
482B Racine	Slight	Slight	Moderate: slope.	Slight	Slight.
482C, 482C2 Racine	Slight	Slight	Severe: slope.	Slight	Slight.
482D2 Racine	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
482F2 Racine	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
485 Spillville	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
487B*:					
Otter	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
Worthen	Slight	Slight	Moderate: slope.	Slight	Slight.
488C2 Newvienna	Slight	Slight	Severe: slope.	Slight	Slight.
488D2 Newvienna	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
490 Caneek	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
496B*:					
Dorchester	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Volney	Severe: flooding.	Moderate: small stones.	Severe: small stones.	Moderate: large stones.	Moderate: small stones, large stones, flooding.
497F*:					
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Dubuque	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: 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
497F*:					
Schapville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
499D Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.	Severe: thin layer.
499F Nordness	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.	Severe: slope, thin layer.
512D Marlean	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate.
520 Coppock	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
563D*, 563D2*:					
Rozetta	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Eleroy	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
563E*, 563E2*:					
Rozetta	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Eleroy	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
589+ Otter	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
663D2 Seaton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
663F Seaton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
712E Schapville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope, thin layer.
712F Schapville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
714C Winneshiek	Slight	Slight	Severe: slope.	Slight	Moderate: thin layer.
726 Hayfield	Slight	Slight	Slight	Slight	Slight.
763E2, 763F2 Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
777B Wapsie	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
814B------------------ Rockton	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight----------	Moderate: thin layer.
814C------------------ Rockton	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: thin layer.
915C, 915C2----------- Rollingstone	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
915D2----------------- Rollingstone	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
930B------------------ Orion	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
951F------------------ Medary	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
964F*:					
Fayette---------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Rock outcrop.					
978B------------------ Festina	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
981B------------------ Worthen	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
1490------------------ Caneek	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
4110B*: Urban land.					
Lamont----------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
4158B*: Urban land.					
Dorchester------------	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
4163C*:					
Fayette---------------	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
Urban land.					
4163D*:					
Fayette---------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Urban land.					

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
4163E*:					
Fayette---------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
4163E*:					
Urban land.					
5030*.					
Pits					
5040B, 5040D.					
Orthents					
5070*:					
Psamments.					
Urban land.					

* 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 herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
27B----------------- Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
41C----------------- Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
63C----------------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
63D, 63F------------ Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
65E2, 65F----------- Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
83B----------------- Kenyon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
83C----------------- Kenyon	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Fair.
84------------------ Clyde	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
97*:										
Lawson--------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Huntsville----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
109C, 109D---------- Backbone	Very 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, 110D---------- Lamont	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
119----------------- Muscatine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
120B---------------- Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
120C, 120C2--------- Tama	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
129B*:										
Chaseburg-----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Arenzville----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
142----------------- Chaseburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
152----------------- Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
158----------------- Dorchester	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	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
162B---------------- Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
162C, 162C2, 162D, 162D2-------------- Downs	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
162E2--------------- Downs	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	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.
163D3--------------- Fayette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
163E, 163E2, 163E3, 163F, 163F2, 163F3-------------- 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.
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.
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.
183D, 183D2--------- Dubuque	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
183E, 183E2--------- Dubuque	Poor	Fair	Fair	Fair	Fair.	Very poor.	Very poor.	Fair	Fair	Very poor.
198B---------------- Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
249B---------------- Zwingle	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
284B---------------- Flagler	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
285D---------------- Burkhardt	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
291----------------- Atterberry	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
315*. Udifluvents										

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
320-----------------Arenzville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
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.
407B-----------------Schley	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
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, 412D-----------Sogn	Very poor	Poor	Poor	---	---	Very poor.	Very poor.	Very poor.	---	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.
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.
480F2----------------Orwood	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
482B-----------------Racine	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
482C, 482C2, 482D2-Racine	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
482F2----------------Racine	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
485------------------Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
487B*:										
Otter---------------	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Worthen-------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
488C2, 488D2---------Newvienna	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
490 Caneek	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Poor	Good.
496B*:										
Dorchester	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
Volney	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
497F*:										
Fayette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Dubuque	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Schapville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
499D Nordness	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
499F Nordness	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
512D Marlean	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.
520 Coppock	Good	Good	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
563D*, 563D2*:										
Rozetta	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Eleroy	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
563E*, 563E2*:										
Rozetta	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Eleroy	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
589+ Otter	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
663D2 Seaton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
663F Seaton	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
712E Schapville	Very poor.	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
712F Schapville	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
714C Winneshiek	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
726 Hayfield	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
763E2, 763F2: Exette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
777B: Wapsie	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
814B, 814C: Rockton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
915C, 915C2, 915D2: Rollingstone	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
930B: Orion	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good	Good.
951F: Medary	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
964F*:										
Fayette	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rock outcrop.										
978B: Festina	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
981B: Worthen	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
1490: Caneek	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Poor	Good.
4110B*: Urban land.										
Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
4158B*: Urban land.										
Dorchester	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
4163C*, 4163D*:										
Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
4163E*:										
Fayette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Urban land.										
5030*. Pits										
5040B, 5040D. Orthents										
5070*: Psamments.										
Urban land.										

* 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; it 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
27B: Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
41C: Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63C: Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63D: Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
63F: Chelsea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65E2, 65F: Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
83B: Kenyon	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
83C: Kenyon	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
84: Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
97*:						
Lawson	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
Huntsville	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
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.
109D: Backbone	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: slope, thin layer.
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.
110D: Lamont	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
119: Muscatine	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, 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
120B Tama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
120C, 120C2 Tama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
129B*:						
Chaseburg	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Arenzville	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
142 Chaseburg	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
152 Marshan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
158 Dorchester	Severe: excess humus.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
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.
162E2 Downs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action, low strength.	Severe: 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.
163D3 Fayette	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
163E, 163E2 Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: 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
163E3-------------- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
163F, 163F2-------- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
163F3-------------- Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
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.
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.
183D, 183D2-------- 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.
183E, 183E2-------- Dubuque	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
198B--------------- Floyd	Severe: cutbanks cave, excess humus, wetness.	Severe: low strength.	Severe: wetness.	Severe: low strength.	Severe: low strength, frost action.	Slight.
249B--------------- Zwingle	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
284B--------------- Flagler	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
285D--------------- Burkhardt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
291---------------- Atterberry	Severe: 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
315*. Udifluvents						
320---------------- Arenzville	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
391B*:						
Clyde------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, 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.
407B-------------- Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
408B-------------- Olin	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
408C-------------- Olin	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
412C-------------- Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
412D-------------- Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer.
428B-------------- Ely	Severe: wetness.	Severe: low strength.	Severe: low strength, wetness.	Severe: low strength.	Severe: frost action, low strength.	Slight.
462B-------------- Downs	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.
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.
480F2------------- Orwood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
482B-------------- Racine	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: 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
482C, 482C2: Racine	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
482D2: Racine	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
482F2: Racine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
485: Spillville	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
487B*:						
Otter	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
Worthen	Slight	Slight	Slight	Slight	Severe: low strength, frost action.	Slight.
488C2: Newvienna	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
488D2: Newvienna	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
490: Caneek	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
496B*:						
Dorchester	Severe: excess humus.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
Volney	Moderate: dense layer, large stones, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: small stones, large stones, flooding.
497F*:						
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Dubuque	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Schapville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
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.
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.

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
512D----------------- Marlean	Moderate: dense layer, large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Moderate.
520----------------- Coppock	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
563D*, 563D2*:						
Rozetta-----------	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Eleroy-----------	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
563E*, 563E2*:						
Rozetta-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, frost action.	Severe: slope.
Eleroy-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
589+---------------- Otter	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
663D2--------------- Seaton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
663F---------------- Seaton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
712E---------------- Schapville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
712F---------------- Schapville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
714C---------------- 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.
726----------------- Hayfield	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Severe: frost action.	Slight.
763E2, 763F2------- Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
777B---------------- Wapsie	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	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
814B: Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Moderate: thin layer.
814C: Rockton	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Moderate: thin layer.
915C, 915C2: Rollingstone	Moderate: too clayey, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Severe: low strength.	Slight.
915D2: Rollingstone	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Severe: low strength.	Moderate: slope.
930B: Orion	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
951F: Medary	Severe: slope.	Severe: slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
964F*:						
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Rock outcrop.						
978B: Festina	Slight	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: low strength, frost action.	Slight.
981B: Worthen	Slight	Slight	Slight	Slight	Severe: low strength, frost action.	Slight.
1490: Caneek	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
4110B*: Urban land.						
Lamont	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
4158B*: Urban land.						
Dorchester	Severe: excess humus.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.	Severe: frost action.	Slight.
4163C*:						
Fayette	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
Urban land.						

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
4163D*:						
Fayette----------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
Urban land.						
4163E*:						
Fayette----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Urban land.						
5030*. Pits						
5040B, 5040D. Orthents						
5070*: Psamments.						
Urban land.						

* 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; it 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
27B----- Terril	Slight-----	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
41C----- Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
63C, 63D----- 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.
65E2, 65F----- Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
83B----- Kenyon	Moderate: percs slowly.	Moderate: slope, seepage.	Slight-----	Slight-----	Good.
83C----- Kenyon	Moderate: percs slowly.	Severe: slope.	Slight-----	Slight-----	Good.
84----- Clyde	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
97*:					
Lawson-----	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Huntsville-----	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
109C, 109D----- Backbone	Severe: depth to rock, percs slowly.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock, seepage.	Poor: area reclaim.
110B----- Lamont	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
110C----- Lamont	Slight-----	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
110D----- Lamont	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
119----- Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
120B----- Tama	Slight-----	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
120C, 120C2: Tama	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
129B*:					
Chaseburg	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Arenzville	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, too sandy.	Severe: flooding, wetness.	Poor: too sandy.
142: Chaseburg	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
152: Marshan	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
158: Dorchester	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: thin layer.
162B: Downs	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
162C, 162C2: Downs	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
162D, 162D2: Downs	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
162E2: Downs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
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.
163D3: Fayette	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
163E, 163E2, 163E3, 163F, 163F2, 163F3, 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.

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
171D, 171D2: Bassett	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
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.
183D, 183D2: Dubuque	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
183E, 183E2: Dubuque	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
198B: Floyd	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
249B: Zwingle	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness, seepage.	Severe: wetness.	Poor: wetness, too clayey, hard to pack.
284B: Flagler	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
285D: Burkhardt	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
291: Atterberry	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
315*. Udifluvents					
320: Arenzville	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, too sandy.	Severe: flooding, wetness.	Poor: too sandy.
391B*:					
Clyde	Severe: wetness.	Severe: wetness.	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.
407B: Schley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
408B----------------- Olin	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
408C----------------- Olin	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
412C----------------- Sogn	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
412D----------------- Sogn	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
428B----------------- Ely	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
462B----------------- Downs	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
478G*:					
Nordness------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
Rock outcrop.					
480C, 480C2---------- Orwood	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
480D, 480D2---------- Orwood	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
480F2---------------- Orwood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
482B----------------- Racine	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey, small stones.
482C, 482C2---------- Racine	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey, small stones.
482D2---------------- Racine	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
482F2---------------- Racine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
485------------------ Spillville	Severe: wetness, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, seepage, flooding.	Severe: wetness, flooding.	Fair: wetness.
487B*:					
Otter----------------	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
Worthen--------------	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
488C2: Newvienna	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
488D2: Newvienna	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, slope, wetness.
490: Caneek	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
496B*:					
Dorchester	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: thin layer.
Volney	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, large stones.	Severe: flooding, seepage.	Poor: large stones.
497F*:					
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Dubuque	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Schapville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
499D: Nordness	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
499F: Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
512D: Marlean	Moderate: large stones, slope.	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: seepage.	Poor: small stones.
520: Coppock	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
563D*, 563D2*:					
Rozetta	Moderate: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: too clayey, slope.
Eleroy	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: depth to rock.	Moderate: depth to rock, wetness, slope.	Poor: thin layer.
563E*, 563E2*:					
Rozetta	Severe: slope.	Severe: slope.	Severe: wetness.	Severe: slope.	Poor: 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
563E*, 563E2*:					
Eleroy	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope, thin layer.
589+ Otter	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
663D2 Seaton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
663F Seaton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
712E Schapville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, area reclaim.
712F Schapville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
714C Winneshiek	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
726 Hayfield	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
763E2, 763F2 Exette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
777B Wapsie	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
814B Rockton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
814C Rockton	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
915C, 915C2 Rollingstone	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack, small stones.
915D2 Rollingstone	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack, small stones.
930B Orion	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
951F Medary	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: 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
964F*:					
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
978B Festina	Moderate: flooding.	Moderate: slope, seepage.	Severe: seepage.	Slight	Fair: too clayey.
981B Worthen	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
1490 Caneek	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
4110B*: Urban land.					
Lamont	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
4158B*: Urban land.					
Dorchester	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Poor: thin layer.
4163C*:					
Fayette	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
4163D*:					
Fayette	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Urban land.					
4163E*:					
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Urban land.					
5030*. Pits					
5040B, 5040D. Orthents					
5070*: Psamments.					
Urban land.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
27B Terril	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
41C Sparta	Good	Probable	Improbable: too sandy.	Poor: thin layer.
63C Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
63D Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
63F Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
65E2, 65F Lindley	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
83B, 83C Kenyon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
84 Clyde	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
97*:				
Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Huntsville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
109C Backbone	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
109D Backbone	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
110B, 110C Lamont	Good	Probable	Improbable: too sandy.	Good.
110D Lamont	Good	Probable	Improbable: too sandy.	Fair: slope.
119 Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
120B, 120C, 120C2 Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
129B*:				
Chaseburg	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Arenzville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
142 Chaseburg	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
152 Marshan	Fair: wetness.	Probable	Probable	Fair: area reclaim, thin layer.
158 Dorchester	Fair: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
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.
162E2 Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
163B, 163C, 163C2 Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
163D, 163D2 Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, thin layer.
163D3 Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
163E, 163E2, 163E3, 163F, 163F2, 163F3 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.
171D, 171D2 Bassett	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
175B Dickinson	Good	Probable	Improbable: too sandy.	Good.
175C Dickinson	Good	Probable	Improbable: too sandy.	Good.
183D, 183D2 Dubuque	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
183E, 183E2 Dubuque	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
198B Floyd	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
249B Zwingle	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
284B----- Flagler	Good-----	Probable-----	Probable-----	Fair: small stones, area reclaim, thin layer.
285D----- Burkhardt	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
291----- Atterberry	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
315*. Udifluvents				
320----- Arenzville	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
391B*: Clyde-----	Poor: low strength.	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.
407B----- Schley	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
408B, 408C----- Olin	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
412C, 412D----- Sogn	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
428B----- Ely	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
462B----- Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
478G*: Nordness-----	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
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.
480F2----- Orwood	Poor: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
482B, 482C, 482C2----- Racine	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
482D2----- Racine	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
482F2: Racine	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
485: Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
487B*:				
Otter	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Worthen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
488C2: Newvienna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
488D2: Newvienna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
490: Caneek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
496B*:				
Dorchester	Fair: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
Volney	Fair: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones.
497F*:				
Fayette	Poor: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Dubuque	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Schapville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
499D: Nordness	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
499F: Nordness	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
512D: Marlean	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
520: Coppock	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
563D*, 563D2*:				
Rozetta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Eleroy	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
563E*, 563E2*:				
Rozetta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Eleroy	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
589+ Otter	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
663D2 Seaton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
663F Seaton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
712E Schapville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
712F Schapville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
714C Winneshiek	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
726 Hayfield	Fair: wetness.	Probable	Improbable: too sandy.	Poor: area reclaim.
763E2, 763F2 Exette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
777B Wapsie	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
814B, 814C Rockton	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
915C, 915C2, 915D2 Rollingstone	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
930B Orion	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
951F Medary	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
964F*:				
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop.				
978B Festina	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
981B Worthen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1490 Caneek	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
4110B*: Urban land.				
Lamont	Good	Probable	Improbable: too sandy.	Good.
4158B*: Urban land.				
Dorchester	Fair: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
4163C*: Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Urban land.				
4163D*: Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, thin layer.
Urban land.				
4163E*: Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Urban land.				
5030*. Pits				
5040B, 5040D. Orthents				
5070*: Psamments.				
Urban land.				

* 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; it 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
27B----------------Terril	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
41C----------------Sparta	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
63C----------------Chelsea	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
63D, 63F----------Chelsea	Severe: slope, seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
65E2, 65F---------Lindley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope----------	Slope.
83B, 83C----------Kenyon	Moderate: slope, seepage.	Moderate: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
84----------------Clyde	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness--------	Wetness, erodes easily.
97*:						
Lawson-----------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Huntsville-------	Moderate: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
109C---------------Backbone	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, soil blowing.	Depth to rock, rooting depth.
109D---------------Backbone	Severe: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, soil blowing.	Slope, depth to rock, rooting depth.
110B, 110C--------Lamont	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
110D---------------Lamont	Severe: slope, seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
119----------------Muscatine	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness, erodes easily.	Erodes easily.
120B, 120C, 120C2-Tama	Moderate: slope, seepage.	Slight---------	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
129B*:						
Chaseburg--------	Moderate: seepage, slope.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
Arenzville-------	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Erodes easily, too sandy.	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
142 Chaseburg	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
152 Marshan	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Wetness.
158 Dorchester	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
162B, 162C, 162C2- Downs	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
162D, 162D2, 162E2 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	Favorable	Erodes easily.
163D, 163D2 Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.
163D3 Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
163E, 163E2 Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.
163E3 Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
163F, 163F2 Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.
163F3 Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
163G Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.
171B, 171C, 171C2- Bassett	Moderate: seepage slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
171D, 171D2 Bassett	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope.
175B Dickinson	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, too sandy.	Favorable.
175C Dickinson	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, too sandy.	Favorable.
183D, 183D2, 183E, 183E2 Dubuque	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
198B Floyd	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness	Favorable.

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
249B: Zwingle	Moderate: slope, seepage.	Moderate: thin layer, hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
284B: Flagler	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.
285D: Burkhardt	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
291: Atterberry	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
315*. Udifluvents						
320: Arenzville	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Erodes easily, too sandy.	Erodes easily.
391B*:						
Clyde	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness, erodes easily.
Floyd	Severe: seepage.	Moderate: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness	Favorable.
394B, 394C: Ostrander	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
407B: Schley	Moderate: slope, seepage.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Wetness	Wetness, rooting depth.
408B, 408C: Olin	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Soil blowing	Favorable.
412C: Sogn	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
412D: Sogn	Severe: depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
428B: Ely	Moderate: slope, seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Slope, frost action.	Erodes easily, wetness.	Erodes easily.
462B: Downs	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
478G*:						
Nordness	Severe: slope, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Rock outcrop.						
480C, 480C2: Orwood	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
480D, 480D2, 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
482B, 482C, 482C2-- Racine	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
482D2, 482F2------ Racine	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope.
485--------------- Spillville	Moderate: seepage.	Moderate: piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Favorable------	Favorable.
487B*:						
Otter-------------	Moderate: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, flooding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
Worthen-----------	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
488C2------------- Newvienna	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
488D2------------- Newvienna	Severe: slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily.
490--------------- Caneek	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
496B*:						
Dorchester--------	Moderate: slope, seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Volney------------	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones---	Large stones, rooting depth.
497F*:						
Fayette-----------	Severe: slope.	Slight----------	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.
Dubuque-----------	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Schapville--------	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, wetness.	Slope, depth to rock, percs slowly.
499D, 499F-------- Nordness	Severe: slope, depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
512D-------------- Marlean	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, soil blowing.	Large stones, slope, droughty.
520--------------- Coppock	Moderate: seepage.	Severe: hard to pack, wetness.	Moderate: slow refill.	Frost action---	Wetness, erodes easily.	Wetness, erodes easily.
563D*, 563D2*, 563E*, 563E2*:						
Rozetta-----------	Severe: slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	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
563D*, 563D2*, 563E*, 563E2*:						
Eleroy----------	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
589+-------------- Otter	Moderate: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, flooding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
663D2, 663F------- Seaton	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
712E, 712F-------- Schapville	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock, percs slowly.
714C-------------- Winneshiek	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
726--------------- Hayfield	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, too sandy.	Favorable.
763E2, 763F2------ Exette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
777B-------------- Wapsie	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Favorable.
814B, 814C-------- Rockton	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
915C, 915C2------- Rollingstone	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily.
915D2------------- Rollingstone	Severe: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
930B-------------- Orion	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
951F-------------- Medary	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, rooting depth.
964F*:						
Fayette----------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.
Rock outcrop.						
978B-------------- Festina	Moderate: seepage, slope.	Moderate: thin layer, 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.
1490-------------- Caneek	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
4110B*: Urban land.						
Lamont	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Soil blowing	Favorable.
4158B*: Urban land.						
Dorchester	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
4163C*: Fayette	Moderate: slope, seepage.	Slight	Severe: no water.	Deep to water	Favorable	Erodes easily.
Urban land.						
4163D*, 4163E*: Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.
Urban land.						
5030*. Pits						
5040B, 5040D. Orthents						
5070*: Psamments.						
Urban land.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
27B----------------- Terril	0-30	Loam---------------	CL	A-6	0-5	100	95-100	70-90	60-80	30-40	11-20
	30-60	Clay loam, loam	CL	A-6	0-5	100	100	85-95	65-85	25-40	11-20
41C----------------- Sparta	0-22	Loamy fine sand	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	22-40	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
	40-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
63C, 63D, 63F---- Chelsea	0-9	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	9-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
65E2--------------- Lindley	0-7	Loam---------------	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	11-15
	7-46	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	46-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	11-15
65F----------------- Lindley	0-7	Loam---------------	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	11-15
	7-30	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	30-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	11-15
83B, 83C----------- Kenyon	0-13	Loam---------------	CL	A-6	0	100	95-100	85-95	65-75	30-40	11-20
	13-57	Loam, clay loam, sandy clay loam.	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	11-20
	57-60	Loam---------------	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	11-20
84------------------ Clyde	0-22	Loam---------------	ML, OL, CL	A-4, A-6	0-5	95-100	95-100	80-90	55-75	30-40	5-15
	22-43	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	11-20
	43-60	Loam---------------	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	11-20
97*:											
Lawson------------	0-31	Silt loam----------	CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	5-10
	31-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	80-100	20-40	11-25
Huntsville--------	0-38	Silt loam----------	CL	A-6	0	100	95-100	90-100	85-100	25-40	11-20
	38-60	Silt loam, loam, very fine sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6, A-2	0	95-100	90-100	85-95	30-85	20-35	5-20
109C, 109D-------- Backbone	0-7	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	75-85	15-40	15-25	5-10
	7-22	Sandy loam---------	SC, SM-SC	A-2, A-4	0-2	90-95	90-95	65-80	20-40	15-25	5-10
	22-26	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
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
110B, 110C, 110D- Lamont	0-4	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	4-9	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	9-36	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
	36-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
119----------------- Muscatine	0-18	Silt loam----------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	18-48	Silty clay loam	CL	A-7	0	100	100	100	95-100	41-50	20-30
	48-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
120B, 120C, 120C2------------ Tama	0-23	Silt loam--------	ML	A-6, A-7	0	100	100	100	95-100	35-50	11-20
	23-38	Silty clay loam	CL	A-7	0	100	100	100	95-100	41-50	15-25
	38-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
129B*: Chaseburg--------	0-7	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	85-100	<26	3-7
	7-60	Silt loam--------	ML, CL-ML, CL	A-4	0	85-100	85-100	80-100	75-100	<28	3-9
Arenzville------	0-27	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	80-90	25-35	5-10
	27-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	85-95	20-45	5-20
142-------------- Chaseburg	0-7	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	85-100	<26	3-7
	7-60	Silt loam--------	ML, CL-ML, CL	A-4	0	85-100	85-100	80-100	75-100	<28	3-9
152-------------- Marshan	0-17	Loam-------------	ML, CL	A-6, A-4	0	95-100	95-100	95-100	60-90	30-40	5-15
	17-30	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
	30-39	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
	39-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
158-------------- Dorchester	0-28	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-95	25-35	5-10
	28-60	Silt loam, silty clay loam, clay loam.	OL, ML, CL	A-6, A-7	0	100	100	95-100	90-95	35-45	11-20
162B, 162C, 162C2, 162D, 162D2, 162E2---- Downs	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	16-40	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	11-20
163B, 163C, 163C2, 163D, 163D2------------ Fayette	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-46	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	11-20
163D3------------ Fayette	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	6-46	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	11-20
163E, 163E2------ Fayette	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-46	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	11-20
163E3------------ Fayette	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	6-46	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	11-20
163F, 163F2------ Fayette	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-46	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	11-20

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	
163F3------------- Fayette	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	6-46	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	11-20
163G-------------- Fayette	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-46	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	11-20
171B, 171C, 171C2, 171D, 171D2----------- Bassett	0-14	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	14-46	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
	46-60	Loam-------------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	11-20
175B, 175C------- Dickinson	0-8	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	8-32	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	32-60	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
183D, 183D2, 183E, 183E2----- Dubuque	0-11	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	11-22	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	22-27	Clay, silty clay	CH	A-7	2-10	85-95	80-90	70-85	65-85	50-70	30-45
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
198B------------- Floyd	0-19	Loam-------------	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	19-31	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	31-60	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
249B------------- Zwingle	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	9-48	Silty clay, silty clay loam, clay.	CH	A-7	0	100	100	100	95-100	55-70	30-40
	48-60	Stratified loam to loamy sand.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	90-95	60-95	40-80	20-30	5-15
284B------------- Flagler	0-15	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	60-70	25-40	15-25	5-10
	15-30	Sandy loam-------	SC, SM-SC	A-2, A-4	0	95-100	90-95	50-70	25-40	15-25	5-10
	30-60	Loamy sand, gravelly sand.	SP-SM, SW, SP, SW-SM	A-1	0-5	70-90	70-85	20-40	3-12	---	NP
285D------------- Burkhardt	0-6	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	95-100	55-70	25-40	<26	2-7
	6-12	Sandy loam, loam	SC, CL	A-2, A-4	0	95-100	85-100	50-95	25-75	15-30	2-10
	12-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1	0	50-85	45-85	20-35	1-5	---	NP
291-------------- Atterberry	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	14-46	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	95-100	35-55	20-30
	46-60	Silt loam, loam	CL	A-6	0	100	100	95-100	95-100	30-40	11-20
315*. Udifluvents											
320-------------- Arenzville	0-36	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	80-90	25-35	5-10
	36-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	85-95	20-45	5-20

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	
391B*:											
Clyde-----------	0-22	Loam-------------	ML, OL, CL	A-4, A-6	0-5	95-100	95-100	80-90	55-75	30-40	5-15
	22-43	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	90-95	75-90	50-75	30-50	11-20
	43-60	Loam-------------	CL, SC	A-6	2-5	90-95	85-90	75-90	45-65	25-35	11-20
Floyd-----------	0-19	Loam-------------	OL, ML, CL	A-4, A-6	0	100	100	80-90	55-75	30-40	5-15
	19-31	Sandy clay loam, loam.	CL	A-6	2-8	90-95	70-80	50-70	50-65	25-35	11-20
	31-60	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	0-18	Loam-------------	CL-ML, CL	A-4, A-6	0	100	98-100	90-95	70-90	25-40	5-15
	18-34	Loam, silt loam	CL, CL-ML	A-4, A-6	0-1	95-100	95-100	90-95	70-90	25-40	5-15
	34-51	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	0-2	95-100	75-98	65-90	45-65	25-35	11-15
	51-60	Loam-------------	CL	A-6	0-1	95-100	90-98	80-95	50-75	25-40	11-20
407B------------- Schley	0-15	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-90	55-75	25-40	5-15
	15-36	Loam, sandy loam, silty clay loam.	CL, SC, SM-SC, CL-ML	A-2, A-4	2-8	90-95	70-80	50-70	20-60	20-30	5-10
	36-60	Loam, sandy clay loam, clay loam.	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-40	11-20
408B, 408C------- Olin	0-7	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	95-100	85-95	30-50	20-30	5-10
	7-34	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-95	80-90	45-65	25-35	11-20
	34-60	Loam, clay loam	CL	A-6	2-5	90-95	85-95	80-90	50-65	25-35	11-20
412C, 412D------- Sogn	0-14	Loam-------------	CL	A-6	0-10	85-100	85-100	85-100	70-95	25-40	11-23
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
428B------------- Ely	0-32	Silt loam, silty clay loam.	CL, OL, OH, MH	A-7, A-6	0	100	100	95-100	95-100	30-55	11-25
	32-47	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	95-100	35-50	11-25
	47-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	100	90-100	85-100	25-40	11-20
462B------------- Downs	0-17	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	17-39	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	39-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	11-20
478G*:											
Nordness--------	0-4	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	4-9	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-90	35-45	15-25
	9-13	Silty clay loam	CL, CH	A-7	2-10	85-95	80-90	70-85	65-85	45-60	30-40
	13	Unweathered bedrock, weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
480C, 480C2, 480D, 480D2, 480F2----------- Orwood	0-6	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-90	30-40	8-15
	6-39	Silt loam, loam, clay loam.	CL	A-6	0	100	100	85-95	60-80	30-40	11-20
	39-60	Silt loam, loam	CL	A-6	0	100	100	85-95	70-90	30-40	11-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
482B, 482C, 482C2, 482D2, 482F2----------- Racine	0-18	Loam-------------	ML	A-4, A-6	0	95-100	95-100	90-100	55-85	30-40	5-14
	18-50	Clay loam, sandy clay loam, loam.	CL, SC	A-4, A-2, A-6	0-3	85-100	75-95	65-90	30-85	20-40	NP-15
	50-60	Loam-------------	CL, SC	A-4, A-6	0-3	85-100	80-95	70-90	35-75	20-40	3-20
485-------------- Spillville	0-40	Loam-------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	11-20
	40-60	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
487B*: Otter-----------	0-34	Silt loam--------	CL	A-6, A-7, A-4	0	100	95-100	90-100	80-100	25-45	7-20
	34-60	Silt loam, loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	80-100	30-45	11-20
Worthen---------	0-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
488C2, 488D2----- Newvienna	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	7-37	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	37-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	11-20
490-------------- Caneek	0-40	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-95	25-35	5-10
	40-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	11-20
496B*: Dorchester------	0-28	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-95	25-35	5-10
	28-60	Silt loam, silty clay loam, clay loam.	OL, ML, CL	A-6, A-7	0	100	100	95-100	90-95	35-45	11-20
Volney----------	0-26	Channery silt loam.	CL, SC, GC, GM-GC	A-4, A-6	20-30	60-80	60-70	55-65	40-60	25-35	5-15
	26-60	Channery silt loam. channery loam, very channery silt loam.	GM, GC, SM, SC	A-1, A-2, A-4	50-75	40-75	30-65	20-50	15-40	20-30	3-10
497F*: Fayette---------	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-46	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	11-20
Dubuque---------	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	7-24	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	24-27	Clay, silty clay	CH	A-7	2-10	85-95	80-90	70-85	65-85	50-70	30-45
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Schapville------	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	22-40	3-14
	7-23	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
	23-60	Weathered 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	
499D, 499F------- Nordness	0-4	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	4-9	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-90	35-45	15-25
	9-13	Silty clay loam	CL, CH	A-7	2-10	85-95	80-90	70-85	65-85	45-60	30-40
	13	Unweathered bedrock, weathered bedrock.	---	---	---	---	---	---	---	---	---
512D------------- Marlean	0-14	Sandy loam-------	SM, SM-SC	A-4	0-10	85-100	80-100	75-85	35-50	<20	NP-5
	14-60	Flaggy loam, flaggy clay loam, flaggy sandy clay loam.	SM, SC, GM, GC	A-4, A-2, A-1	20-50	25-55	25-55	15-50	12-40	<20	NP-10
520-------------- Coppock	0-9	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	11-20
	9-48	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	11-20
	48-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	98-100	95-100	35-55	15-25
563D*, 563D2*, 563E*:											
Rozetta--------	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	24-35	8-15
	7-33	Silty clay loam	CL	A-7, A-6	0	100	100	95-100	95-100	35-50	15-30
	33-79	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	25-40	11-20
Eleroy---------	0-7	Silt loam--------	CL-ML, CL	A-6, A-4	0	100	100	90-100	80-95	25-40	5-15
	7-40	Silty clay loam	CL	A-7, A-6	0	100	100	90-100	85-95	30-50	15-30
	40-60	Weathered bedrock	CL, CH	A-7, A-6	0	95-100	90-100	85-100	75-95	30-55	15-30
563E2*:											
Rozetta---------	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	24-35	8-15
	7-33	Silty clay loam	CL	A-7, A-6	0	100	100	95-100	95-100	35-50	15-30
	33-79	Silt loam--------	CL	A-6	0	100	100	95-100	95-100	25-40	11-20
Eleroy----------	0-7	Silt loam--------	CL-ML, CL	A-6, A-4	0	100	100	90-100	80-95	25-40	5-15
	7-40	Silty clay loam	CL	A-7, A-6	0	100	100	90-100	85-95	30-50	15-30
	40-60	Weathered bedrock	CL, CH	A-7, A-6	0	95-100	90-100	85-100	75-95	30-55	15-30
589+------------- Otter	0-60	Silt loam--------	CL	A-6, A-7, A-4	0	100	95-100	90-100	80-100	25-45	7-20
663D2, 663F------ Seaton	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	9-60	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	90-100	25-40	5-20
712E, 712F------- Schapville	0-14	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	22-40	3-14
	14-23	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
	23	Weathered bedrock	---	---	---	---	---	---	---	---	---
714C------------- Winneshiek	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	55-70	20-30	5-15
	13-23	Loam, clay loam	CL	A-6	2-5	90-95	80-95	80-90	50-65	25-40	11-20
	23-27	Clay, silty clay	CH	A-7	2-10	85-95	80-95	80-90	70-90	55-70	30-45
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
726-------------- Hayfield	0-12	Loam-------------	CL-ML, CL	A-6, A-4	0	100	100	90-98	70-90	25-40	6-15
	12-34	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
	34-60	Coarse sand, gravelly coarse sand, sand.	SP, SP-SM, SM	A-1	0-3	85-100	50-98	25-50	0-15	---	NP
763E2------------ Exette	0-7	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	100	95-100	25-35	5-10
	7-20	Silt loam--------	ML, CL	A-6, A-4	0	100	100	100	95-100	30-40	7-15
	20-60	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	7-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
763F2------------- Exette	0-7	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	100	95-100	25-35	5-10
	7-20	Silt loam---------	ML, CL	A-6, A-4	0	100	100	100	95-100	30-40	7-15
	20-30	Silt loam---------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	7-15
777B------------- Wapsie	0-12	Loam--------------	CL, ML, CL-ML	A-4	0	100	90-100	70-90	50-75	25-35	5-10
	12-28	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	85-95	80-95	70-85	40-60	20-35	5-15
	28-60	Gravelly loamy sand, gravelly sand, sand.	SW, SM, SP, SP-SM	A-1	0	60-90	60-85	20-40	3-25	---	NP
814B, 814C-------- Rockton	0-19	Loam--------------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	19-25	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	11-20
	25-29	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	41-60	20-35
	29	Weathered bedrock	---	---	---	---	---	---	---	---	---
915C, 915C2, 915D2------------ Rollingstone	0-6	Silt loam---------	CL, ML, CL-ML	A-4	0-5	95-100	92-100	90-100	90-100	15-25	3-10
	6-12	Silt loam---------	CL, ML, CL-ML	A-4, A-6	0-5	95-100	92-100	90-100	90-100	15-30	3-15
	12-60	Clay, cherty clay	CH, SC, GC	A-7	10-35	60-90	55-85	50-80	40-70	50-70	20-40
930B------------- Orion	0-5	Silt loam---------	CL, CL-ML	A-4	0	100	100	85-100	80-100	20-30	4-10
	5-60	Stratified silt loam to very fine sand.	CL, CL-ML	A-4	0	100	100	90-100	70-80	20-30	4-10
951F------------- Medary	0-6	Silt loam---------	CL, CL-ML	A-4	0	100	100	90-100	60-75	20-30	5-10
	6-10	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	60-95	20-40	5-20
	10-30	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	100	100	90-100	75-95	41-65	23-41
	30-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	90-100	75-95	50-59	30-35
964F*: Fayette----------	0-10	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-46	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	11-20
Rock outcrop.											
978B------------- Festina	0-15	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	15-36	Silt loam, silty clay loam.	CL	A-6	0	100	100	100	95-100	30-40	11-20
	36-43	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	11-20
	43-60	Stratified silt loam to sand.	SM, SC, ML, CL	A-2, A-4	0	100	100	70-90	15-70	15-30	NP-10
981B------------- Worthen	0-29	Silt loam---------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
	29-60	Silt loam---------	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
1490------------- Caneek	0-40	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-95	25-35	5-10
	40-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-95	35-45	11-20
4110B*: Urban land.											

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	
4110B*:											
Lamont----------	0-4	Fine sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	4-9	Fine sandy loam, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	100	80-95	15-50	<25	NP-5
	9-36	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
	36-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
4158B*: Urban land.											
Dorchester------	0-28	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-95	25-35	5-10
	28-60	Silt loam, silty clay loam, clay loam.	OL, ML, CL	A-6, A-7	0	100	100	95-100	90-95	35-45	11-20
4163C*, 4163D*, 4163E*:											
Fayette--------	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	10-46	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	11-20
Urban land.											
5030*. Pits											
5040B, 5040D. Orthents											
5070*: Psamments.											
Urban land.											

* 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		Wind erodibility group
								K	T	
	In	Pct	G/cm3	In/hr	In/in	pH				
27B---------------- Terril	0-30	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.24	5	6
	30-60	22-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low-----------	0.32		
41C---------------- Sparta	0-22	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low-----------	0.17	5	2
	22-40	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-6.5	Low-----------	0.17		
	40-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.0	Low-----------	0.17		
63C, 63D, 63F----- Chelsea	0-9	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low-----------	0.17	5	2
	9-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low-----------	0.17		
65E2-------------- Lindley	0-7	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low-----------	0.32	5	6
	7-46	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate------	0.32		
	46-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate------	0.32		
65F---------------- Lindley	0-7	18-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low-----------	0.32	5	6
	7-30	25-35	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate------	0.32		
	30-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate------	0.32		
83B, 83C---------- Kenyon	0-13	20-25	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	5	6
	13-57	20-30	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.28		
	57-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Low-----------	0.37		
84---------------- Clyde	0-22	24-27	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate------	0.28	5	6
	22-43	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate------	0.37		
	43-60	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate------	0.37		
97*:										
Lawson-----------	0-31	10-20	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low-----------	0.28	5	5
	31-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate------	0.43		
Huntsville-------	0-38	18-27	1.15-1.35	0.6-2.0	0.22-0.24	5.6-7.8	Moderate------	0.28	5	6
	38-60	10-25	1.20-1.50	0.6-2.0	0.17-0.21	5.6-7.8	Low-----------	0.28		
109C, 109D-------- Backbone	0-7	8-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low-----------	0.24	4	3
	7-22	12-18	1.55-1.65	2.0-6.0	0.11-0.13	5.1-7.3	Low-----------	0.24		
	22-26	32-42	1.65-1.80	0.2-0.6	0.14-0.16	5.6-7.3	High----------	0.24		
	26	---	---	---	---	---	--------------	-----		
110B, 110C, 110D- Lamont	0-4	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low-----------	0.24	5	3
	4-9	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low-----------	0.24		
	9-36	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low-----------	0.24		
	36-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low-----------	0.17		
119--------------- Muscatine	0-18	24-27	1.28-1.32	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.28	5	6
	18-48	30-35	1.28-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate------	0.43		
	48-60	22-30	1.35-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate------	0.43		
120B, 120C, 120C2------------ Tama	0-23	24-29	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.32	5	7
	23-38	27-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	38-60	22-28	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
129B*:										
Chaseburg--------	0-7	12-16	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.3	Low-----------	0.37	5	5
	7-60	10-18	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.37		
Arenzville-------	0-27	10-18	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low-----------	0.37	5	5
	27-60	10-30	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Moderate------	0.37		
142--------------- Chaseburg	0-7	12-16	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.3	Low-----------	0.37	5	5
	7-60	10-18	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.3	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		Wind erodibility group
								K	T	
	In	Pct	G/cm3	In/hr	In/in	pH				
152 Marshan	0-17	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.28	4	6
	17-30	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate	0.28		
	30-39	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low	0.28		
	39-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low	0.15		
158 Dorchester	0-28	18-24	1.20-1.30	0.6-2.0	0.20-0.22	7.9-8.4	Low	0.37	5	6
	28-60	18-30	1.25-1.40	0.6-2.0	0.22-0.24	6.6-7.8	Moderate	0.37		
162B, 162C, 162C2, 162D, 162D2, 162E2 Downs	0-16	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low	0.32	4	6
	16-40	26-35	1.30-1.35	0.6-2.0	0.18-0.20	4.5-6.0	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 Fayette	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.37	5	6
	10-46	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		
163D3 Fayette	0-6	25-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.37	4	7
	6-46	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		
163E, 163E2 Fayette	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.37	5	6
	10-46	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		
163E3 Fayette	0-6	25-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.37	4	7
	6-46	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		
163F, 163F2 Fayette	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.37	5	6
	10-46	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		
163F3 Fayette	0-6	25-32	1.35-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.37	4	7
	6-46	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		
163G Fayette	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.37	5	6
	10-46	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 Bassett	0-14	18-25	1.45-1.50	0.6-2.0	0.19-0.21	4.5-6.5	Low	0.28	4	6
	14-46	20-28	1.55-1.65	0.6-2.0	0.17-0.19	4.5-5.5	Low	0.28		
	46-60	20-24	1.65-1.80	0.6-2.0	0.17-0.19	5.1-8.4	Low	0.37		
175B, 175C Dickinson	0-8	10-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low	0.20	4	3
	8-32	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.1-6.5	Low	0.20		
	32-60	4-10	1.55-1.65	6.0-20	0.08-0.10	5.1-6.5	Low	0.20		
183D, 183D2, 183E, 183E2 Dubuque	0-11	18-30	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37	4	6
	11-22	26-35	1.30-1.45	0.6-2.0	0.18-0.20	5.6-6.0	Moderate	0.37		
	22-27	40-55	1.50-1.70	0.06-0.2	0.12-0.15	5.6-6.0	High	0.37		
	27	---	---	---	---	---	-----------	----		
198B Floyd	0-19	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate	0.24	5	6
	19-31	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low	0.32		
	31-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low	0.32		
249B Zwingle	0-9	18-35	1.25-1.30	0.2-0.6	0.20-0.22	4.5-7.3	Low	0.43	3	6
	9-48	38-60	1.30-1.45	<0.06	0.12-0.16	4.5-6.5	High	0.43		
	48-60	8-20	1.45-1.60	2.0-6.0	0.08-0.10	6.1-6.5	Low	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/cm3	In/hr	In/in	pH				
284B------------- Flagler	0-15	12-18	1.50-1.55	2.0-6.0	0.12-0.14	5.6-7.3	Low-----------	0.20	4	3
	15-30	10-15	1.55-1.60	2.0-6.0	0.11-0.13	5.1-6.5	Low-----------	0.20		
	30-60	2-8	1.60-1.75	>20	0.02-0.04	5.1-7.3	Low-----------	0.20		
285D------------- Burkhardt	0-6	5-12	1.35-1.55	2.0-6.0	0.13-0.15	5.1-6.5	Low-----------	0.20	3	3
	6-12	8-18	1.55-1.65	2.0-6.0	0.11-0.19	5.1-6.5	Low-----------	0.20		
	12-60	1-6	1.50-1.60	>6.0	0.02-0.04	5.6-6.5	Low-----------	0.10		
291-------------- 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
	14-46	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	46-60	18-27	1.35-1.55	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43		
315*. Udifluvents										
320-------------- Arenzville	0-36	10-18	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low-----------	0.37	5	5
	36-60	10-30	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Moderate------	0.37		
391B*:										
Clyde-----------	0-22	24-27	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	Moderate------	0.28	5	6
	22-43	22-28	1.45-1.65	0.6-2.0	0.18-0.20	6.1-7.3	Moderate------	0.37		
	43-60	20-24	1.70-1.80	0.6-2.0	0.17-0.19	6.6-8.4	Moderate------	0.37		
Floyd-----------	0-19	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate------	0.24	5	6
	19-31	18-24	1.40-1.60	0.6-2.0	0.16-0.18	6.1-7.3	Low-----------	0.32		
	31-60	18-30	1.65-1.80	0.6-2.0	0.16-0.18	6.6-8.4	Low-----------	0.32		
394B, 394C------- Ostrander	0-18	18-27	1.45-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6
	18-34	18-27	1.45-1.55	0.6-2.0	0.17-0.20	5.1-7.3	Low-----------	0.28		
	34-51	13-27	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low-----------	0.28		
	51-60	18-27	1.60-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low-----------	0.37		
407B------------- Schley	0-15	18-22	1.40-1.45	0.6-2.0	0.19-0.21	4.5-6.5	Moderate------	0.32	5	6
	15-36	15-28	1.45-1.65	0.6-2.0	0.12-0.16	4.5-5.5	Low-----------	0.32		
	36-60	20-28	1.65-1.80	0.6-2.0	0.16-0.18	5.1-7.8	Low-----------	0.32		
408B, 408C------- Olin	0-7	12-18	1.45-1.50	2.0-6.0	0.13-0.15	5.6-7.3	Low-----------	0.20	5	3
	7-34	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.1-6.0	Low-----------	0.32		
	34-60	20-28	1.70-1.80	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.32		
412C, 412D------- Sogn	0-14	18-25	1.15-1.20	0.6-2.0	0.17-0.22	6.1-8.4	Moderate------	0.32	1	4L
	14	---	---	---	---	---	-------------	----		
428B------------- Ely	0-32	25-30	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate------	0.32	5	7
	32-47	28-35	1.30-1.40	0.6-2.0	0.18-0.20	6.1-7.3	Moderate------	0.43		
	47-60	20-30	1.40-1.45	0.6-2.0	0.18-0.20	6.6-8.4	Moderate------	0.43		
462B------------- Downs	0-17	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low-----------	0.32	5	6
	17-39	26-35	1.30-1.35	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.43		
	39-60	22-26	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.43		
478G*:										
Nordness--------	0-4	18-24	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43	2	6
	4-9	22-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate------	0.43		
	9-13	27-35	1.35-1.60	0.06-0.2	0.12-0.15	6.6-7.3	High----------	0.43		
	13	---	---	---	---	---	-------------	----		
Rock outcrop.										
480C, 480C2, 480D, 480D2, 480F2----------- Orwood	0-6	18-24	1.35-1.40	0.6-2.0	0.20-0.22	6.6-7.3	Low-----------	0.32	5	6
	6-39	22-28	1.40-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate------	0.43		
	39-60	18-26	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	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/cm3	In/hr	In/in	pH				
482B, 482C, 482C2, 482D2, 482F2 Racine	0-18	18-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.32	5	6
	18-50	18-32	1.55-1.65	0.6-2.0	0.15-0.19	4.5-6.0	Low	0.32		
	50-60	18-27	1.65-1.80	0.6-2.0	0.16-0.19	6.6-7.8	Moderate	0.32		
485 Spillville	0-40	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate	0.28	5	6
	40-60	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low	0.28		
487B*:										
Otter	0-34	18-27	1.10-1.25	0.6-2.0	0.22-0.24	6.1-7.8	Low	0.28	5	6
	34-60	18-27	1.20-1.45	0.6-2.0	0.17-0.22	6.1-7.8	Moderate	0.43		
Worthen	0-60	15-22	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.32	4	6
488C2, 488D2 Newvienna	0-7	18-27	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Low	0.32	5	6
	7-37	27-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.43		
	37-60	15-25	1.35-1.45	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.43		
490 Caneek	0-40	18-24	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Low	0.37	5	4L
	40-60	18-28	1.25-1.40	0.6-2.0	0.22-0.24	6.6-7.3	Moderate	0.37		
496B*:										
Dorchester	0-28	18-24	1.20-1.30	0.6-2.0	0.20-0.22	7.9-8.4	Low	0.37	5	6
	28-60	18-30	1.25-1.40	0.6-2.0	0.22-0.24	6.6-7.8	Moderate	0.37		
Volney	0-26	18-24	1.40-1.55	2.0-6.0	0.13-0.16	7.9-8.4	Low	0.24	2	6
	26-60	12-25	1.70-1.90	>20	0.02-0.08	7.9-8.4	Low	----		
497F*:										
Fayette	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low	0.37	5	6
	10-46	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		
Dubuque	0-7	18-30	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37	4	6
	7-24	26-35	1.30-1.45	0.6-2.0	0.18-0.20	5.6-6.0	Moderate	0.37		
	24-27	40-55	1.50-1.70	0.06-0.2	0.12-0.15	5.6-6.0	High	0.37		
	27	---	---	---	---	---	-------------	----		
Schapville	0-7	20-27	1.10-1.25	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.32	3	6
	7-23	27-40	1.25-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.32		
	23	---	---	---	---	---	-------------	----		
499D, 499F Nordness	0-4	18-24	1.30-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.43	2	6
	4-9	22-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate	0.43		
	9-13	27-35	1.35-1.60	0.06-0.2	0.12-0.15	6.6-7.3	High	0.43		
	13	---	---	---	---	---	-------------	----		
512D Marlean	0-14	8-18	1.45-1.55	2.0-6.0	0.13-0.16	6.1-7.3	Low	0.24	2	3
	14-60	12-28	1.70-1.90	2.0-6.0	0.08-0.15	7.4-7.8	Low	0.24		
520 Coppock	0-9	16-26	1.30-1.35	0.6-2.0	0.20-0.24	6.1-7.3	Moderate	0.32	5	6
	9-48	16-27	1.30-1.40	0.6-2.0	0.18-0.22	5.6-7.3	Moderate	0.43		
	48-60	24-35	1.30-1.40	0.6-2.0	0.17-0.21	4.5-6.0	Moderate	0.43		
563D*, 563D2*, 563E*:										
Rozetta	0-7	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	6
	7-33	27-35	1.35-1.55	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	0.37		
	33-79	20-27	1.40-1.60	0.6-2.0	0.20-0.22	5.6-7.8	Low	0.37		
Eleroy	0-7	22-27	1.25-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	4	6
	7-40	27-35	1.35-1.55	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.37		
	40-60	40-50	1.45-1.80	<0.06	---	7.4-8.4	-------------	----		

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/cm3	In/hr	In/in	pH				
563E2*:										
Rozetta----------	0-7	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	6
	7-33	27-35	1.35-1.55	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37		
	33-79	20-27	1.40-1.60	0.6-2.0	0.20-0.22	5.6-7.8	Low-----------	0.37		
Eleroy-----------	0-7	22-27	1.25-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	4	6
	7-40	27-35	1.35-1.55	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37		
	40-60	40-50	1.45-1.80	<0.06	---	7.4-8.4	-------------	----		
589+-------------- Otter	0-60	18-27	1.10-1.25	0.6-2.0	0.22-0.24	6.1-7.8	Low-----------	0.28	5	6
663D2, 663F------ Seaton	0-9	15-22	1.10-1.20	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	6
	9-60	18-27	1.15-1.30	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37		
712E, 712F------- Schapville	0-14	20-27	1.10-1.25	0.6-2.0	0.22-0.24	5.6-6.5	Low-----------	0.32	3	6
	14-23	27-40	1.25-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.32		
	23-60	---	---	---	---	---	-------------	----		
714C-------------- Winneshiek	0-13	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low-----------	0.28	4	6
	13-23	20-28	1.50-1.70	0.6-2.0	0.17-0.19	5.6-7.3	Low-----------	0.28		
	23-27	40-55	1.70-1.80	0.06-0.2	0.12-0.15	5.6-7.3	High----------	0.28		
	27	---	---	---	---	---	-------------	----		
726--------------- Hayfield	0-12	18-27	1.30-1.50	0.6-2.0	0.20-0.24	5.6-6.5	Low-----------	0.32	5	6
	12-34	18-30	1.40-1.55	0.6-2.0	0.17-0.22	5.1-6.0	Low-----------	0.32		
	34-60	<5	1.55-1.65	6.0-20	0.02-0.04	5.6-7.8	Low-----------	0.15		
763E2------------- Exette	0-7	18-22	1.30-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Low-----------	0.37	5	6
	7-20	22-26	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.37		
	20-60	15-20	1.45-1.50	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.37		
763F2------------- Exette	0-7	18-22	1.30-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Low-----------	0.37	5	6
	7-20	22-26	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.37		
	20-30	15-20	1.45-1.50	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.37		
777B-------------- Wapsie	0-12	12-18	1.40-1.45	0.6-2.0	0.18-0.20	5.6-7.3	Low-----------	0.28	4	5
	12-24	12-18	1.45-1.50	0.6-2.0	0.15-0.17	5.1-6.0	Low-----------	0.28		
	24-60	2-10	1.50-1.75	>20	0.02-0.06	5.1-7.3	Low-----------	0.10		
814B, 814C------- Rockton	0-19	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.28	4	6
	19-25	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28		
	25-29	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High----------	0.28		
	29	---	---	---	---	---	-------------	----		
915C, 915C2, 915D2------------ Rollingstone	0-6	12-25	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	3	6
	6-12	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.1-6.5	Low-----------	0.43		
	12-60	60-80	1.45-1.65	0.06-0.2	0.09-0.14	4.5-5.5	Moderate-----	0.28		
930B-------------- Orion	0-5	10-18	1.20-1.30	0.6-2.0	0.22-0.24	5.6-7.8	Low-----------	0.37	5	5
	5-60	10-18	1.20-1.30	0.6-2.0	0.20-0.22	5.6-7.8	Low-----------	0.37		
951F-------------- Medary	0-6	15-27	1.35-1.60	0.6-2.0	0.22-0.24	5.1-6.5	Low-----------	0.37	3	5
	6-10	25-40	1.55-1.65	0.2-0.6	0.18-0.22	4.5-6.0	Moderate-----	0.37		
	10-30	35-60	1.55-1.70	0.06-0.2	0.11-0.20	4.5-7.3	High----------	0.37		
	30-60	40-60	1.80-1.90	0.06-0.2	0.09-0.13	5.1-7.8	High----------	0.37		
964F*:										
Fayette----------	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6
	10-46	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		
Rock outcrop.										

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/cm3	In/hr	In/in	pH				
978B------------- Festina	0-15	18-24	1.30-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6
	15-36	24-29	1.35-1.40	0.6-2.0	0.20-0.22	5.1-6.0	Moderate-----	0.43		
	36-43	22-26	1.40-1.45	0.6-2.0	0.20-0.22	5.1-6.5	Moderate-----	0.43		
	43-60	8-18	1.45-1.55	2.0-6.0	0.10-0.18	6.1-7.3	Low----------	0.43		
981B------------- Worthen	0-29	15-22	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6
	29-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.43		
1490------------- Caneek	0-40	18-24	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Low----------	0.37	5	4L
	40-60	18-28	1.25-1.40	0.6-2.0	0.22-0.24	6.6-7.3	Moderate-----	0.37		
4110B*: Urban land.										
Lamont----------	0-4	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3
	4-9	5-15	1.50-1.55	2.0-6.0	0.14-0.16	5.1-7.3	Low----------	0.24		
	9-36	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-6.0	Low----------	0.24		
	36-60	2-10	1.65-1.75	6.0-20	0.09-0.11	5.1-6.5	Low----------	0.17		
4158B*: Urban land.										
Dorchester------	0-28	18-24	1.20-1.30	0.6-2.0	0.20-0.22	7.9-8.4	Low----------	0.37	5	6
	28-60	18-30	1.25-1.40	0.6-2.0	0.22-0.24	6.6-7.8	Moderate-----	0.37		
4163C*, 4163D*, 4163E*: Fayette--------	0-10	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
	10-46	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		
Urban land.										
5030*. Pits										
5040B, 5040D. Orthents										
5070*: Psamments.										
Urban land.										

* 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 "brief," "apparent," and "perched" are explained in the text. The sym
> 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	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				
27B-------------- Terril	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
41C-------------- Sparta	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
63C, 63D, 63F----- Chelsea	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
65E2, 65F--------- Lindley	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
83B, 83C---------- 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.
97*:												
Lawson-----------	C	Occasional	Brief-----	Mar-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Low.
Huntsville-------	B	Rare--------	---	---	>6.0	---	---	>60	---	High-----	Low------	Low.
109C, 109D-------- Backbone	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Low------	Low.
110B, 110C, 110D-- Lamont	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
119--------------- Muscatine	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
120B, 120C, 120C2- Tama	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
129B*:												
Chaseburg--------	B	Occasional	Very brief	Nov-Jun	3.0-6.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Moderate.
Arenzville-------	B	Frequent----	Brief-----	Nov-Jun	3.0-6.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Moderate.
142--------------- Chaseburg	B	Occasional	Very brief	Nov-Jun	3.0-6.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Moderate.
152--------------- Marshan	B/D	None--------	---	---	1.0-2.5	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
158--------------- Dorchester	B	Occasional	Very brief to brief.	Feb-Nov	>6.0	---	---	>60	---	High-----	High-----	Low.

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				
162B, 162C, 162C2, 162D, 162D2, 162E2------------ Downs	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
163B, 163C, 163C2, 163D, 163D2, 163D3, 163E, 163E2, 163E3, 163F, 163F2, 163F3, 163G------ Fayette	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
171B, 171C, 171C2, 171D, 171D2------ Bassett	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
175B, 175C-------- Dickinson	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
183D, 183D2, 183E, 183E2------------ Dubuque	B	None--------	---	---	>6.0	---	---	20-30	Hard	High-----	Moderate	Moderate.
198B-------------- Floyd	B	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
249B-------------- Zwingle	D	None--------	---	---	1.0-2.0	Perched	Nov-Jul	>60	---	Moderate	High-----	Moderate.
284B-------------- Flagler	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
285D-------------- Burkhardt	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
291--------------- Atterberry	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jul	>60	---	High-----	High-----	Moderate.
315*. Udifluvents												
320--------------- Arenzville	B	Occasional	Brief-----	Nov-Jun	3.0-6.0	Apparent	Nov-Jun	>60	---	High-----	Moderate	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-Jul	>60	---	High-----	High-----	Low.
394B, 394C-------- Ostrander	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

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				
407B: Schley	B	None	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	High.
408B, 408C: Olin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
412C, 412D: Sogn	D	None	---	---	>6.0	---	---	4-20	Hard	Moderate	Low	Low.
428B: Ely	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
462B: Downs	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
478G*:												
Nordness	B	None	---	---	>6.0	---	---	8-20	Hard	Low	Low	Low.
Rock outcrop.												
480C, 480C2, 480D, 480D2, 480F2: Orwood	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
482B, 482C, 482C2, 482D2, 482F2: Racine	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
485: Spillville	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.
487B*:												
Otter**	B/D	Frequent	Brief	Mar-Jun	+.5-2.0	Apparent	Nov-Jul	>60	---	High	High	Low.
Worthen	B	None	---	---	>6.0	---	---	>60	---	High	Low	Low.
488C2, 488D2: Newvienna	B	None	---	---	2.5-4.0	Apparent	Nov-Jul	>60	---	High	Moderate	Moderate.
490: Caneek	B	Frequent	Very brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Low.
496B*:												
Dorchester	B	Frequent	Very brief to brief.	Feb-Nov	>6.0	---	---	>60	---	High	High	Low.
Volney	B	Occasional	Very brief	Feb-Nov	>6.0	---	---	>60	---	Low	Low	Low.
497F*:												
Fayette	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
Dubuque	B	None	---	---	>6.0	---	---	20-30	Hard	High	Moderate	Moderate.
Schapville	C	None	---	---	2.5-5.0	Perched	Nov-Jul	20-40	Soft	Moderate	High	Moderate.

See footnotes 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				
499D, 499F-------- Nordness	B	None---------	---	---	>6.0	---	---	8-20	Hard	Low-------	Low-------	Low.
512D-------------- Marlean	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
520--------------- Coppock	B	Rare---------	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
563D*, 563D2*, 563E*, 563E2*:												
Rozetta----------	B	None---------	---	---	2.5-5.0	Perched	Nov-Jul	>60	---	High-----	Moderate	Moderate.
Eleroy-----------	B	None---------	---	---	2.5-5.0	Perched	Nov-Jul	40-60	Soft	High-----	High-----	Moderate.
589+**------------ Otter	B/D	Frequent----	Brief-----	Mar-Jun	+.5-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
663D2, 663F------- Seaton	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low-------	Moderate.
712E, 712F-------- Schapville	C	None---------	---	---	2.5-5.0	Perched	Nov-Jul	20-40	Soft	Moderate	High-----	Moderate.
714C-------------- Winneshiek	B	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
726--------------- Hayfield	B	None---------	---	---	2.5-5.0	Apparent	Nov-Jul	>60	---	High-----	Low-------	Moderate.
763E2, 763F2------ Exette	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low-------	Low.
777B-------------- Wapsie	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Moderate.
814B, 814C-------- Rockton	B	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low-------	Low.
915C, 915C2, 915D2------------ Rollingstone	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
930B-------------- Orion	C	Frequent----	Brief-----	Mar-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
951F-------------- Medary	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
964F*:												
Fayette-----------	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
Rock outcrop.												

See footnotes 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				
978B---------------- Festina	B	Rare----------	---	---	>6.0	---	---	>60	---	High------	Moderate	Moderate.
981B---------------- Worthen	B	None----------	---	---	>6.0	---	---	>60	---	High------	Low-------	Low.
1490---------------- Caneek	B	Frequent-----	Very brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High------	High------	Low.
4110B*: Urban land.												
Lamont-------------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Moderate.
4158B*: Urban land.												
Dorchester---------	B	Rare----------	---	---	>6.0	---	---	>60	---	High------	High------	Low.
4163C*, 4163D*, 4163E*: Fayette------------	B	None----------	---	---	>6.0	---	---	>60	---	High------	Moderate	Moderate.
Urban land.												
5030*. Pits												
5040B, 5040D. Orthents												
5070*: Psamments.												
Urban land.												

* See description of the map unit for composition and behavior characteristics of the map unit.

** In the "High water table--Depth" column, 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.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
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
Burkhardt	Sandy, mixed, mesic Typic Hapludolls
Caneek	Fine-silty, mixed (calcareous), mesic Typic Fluvaquents
Chaseburg	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Chelsea	Mixed, mesic Alfic Udipsamments
Clyde	Fine-loamy, mixed, mesic Typic Haplaquolls
Coppock	Fine-silty, mixed, mesic Mollic Ochraqualfs
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dorchester	Fine-silty, mixed (calcareous), mesic Typic Udifluvents
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Dubuque	Fine-silty, mixed, mesic Typic Hapludalfs
Eleroy	Fine-silty, mixed, mesic Typic Hapludalfs
Ely	Fine-silty, mixed, mesic Cumulic Hapludolls
Exette	Fine-silty, mixed, mesic Dystric Eutrochrepts
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
Festina	Fine-silty, mixed, mesic Mollic Hapludalfs
Flagler	Coarse-loamy, mixed, mesic Typic Hapludolls
Floyd	Fine-loamy, mixed, mesic Aquic Hapludolls
Hayfield	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquollic Hapludalfs
Huntsville	Fine-silty, mixed, mesic Cumulic Hapludolls
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lawson	Fine-silty, mixed, mesic Cumulic Hapludolls
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
Marlean	Loamy-skeletal, mixed, mesic Typic Hapludolls
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Medary	Fine, mixed, mesic Typic Hapludalfs
Muscatine	Fine-silty, mixed, mesic Aquic Hapludolls
Newvienna	Fine-silty, mixed, mesic Mollic Hapludalfs
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 Typic Udorthents
Orwood	Fine-loamy, mixed, mesic Mollic Hapludalfs
Ostrander	Fine-loamy, mixed, mesic Typic Hapludolls
Otter	Fine-silty, mixed, mesic Cumulic Haplaquolls
Psamments	Sandy, mixed, mesic Typic Udipsamments
Racine	Fine-loamy, mixed, mesic Mollic Hapludalfs
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Rollingstone	Very-fine, mixed, mesic Typic Paleudalfs
Rozetta	Fine-silty, mixed, mesic Typic Hapludalfs
Schapville	Fine, mixed, mesic Typic Argiudolls
Schley	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Seaton	Fine-silty, mixed, mesic Typic Hapludalfs
Sogn	Loamy, mixed, mesic Lithic Haplustolls
Sparta	Sandy, mixed, mesic Entic Hapludolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls
Tama	Fine-silty, mixed, mesic Typic Argiudolls
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
Udifluvents	Sandy, mixed, mesic Udifluvents
Volney	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Wapsie	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Winneshiek	Fine-loamy, mixed, mesic Mollic Hapludalfs
Worthen	Fine-silty, mixed, mesic Cumulic Hapludolls
Zwingle	Fine, montmorillonitic, mesic Typic Albaqualfs

* 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.

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