Soil Survey of

Olmsted County Minnesota

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Minnesota Agricultural Experiment Station

HOW TO USE

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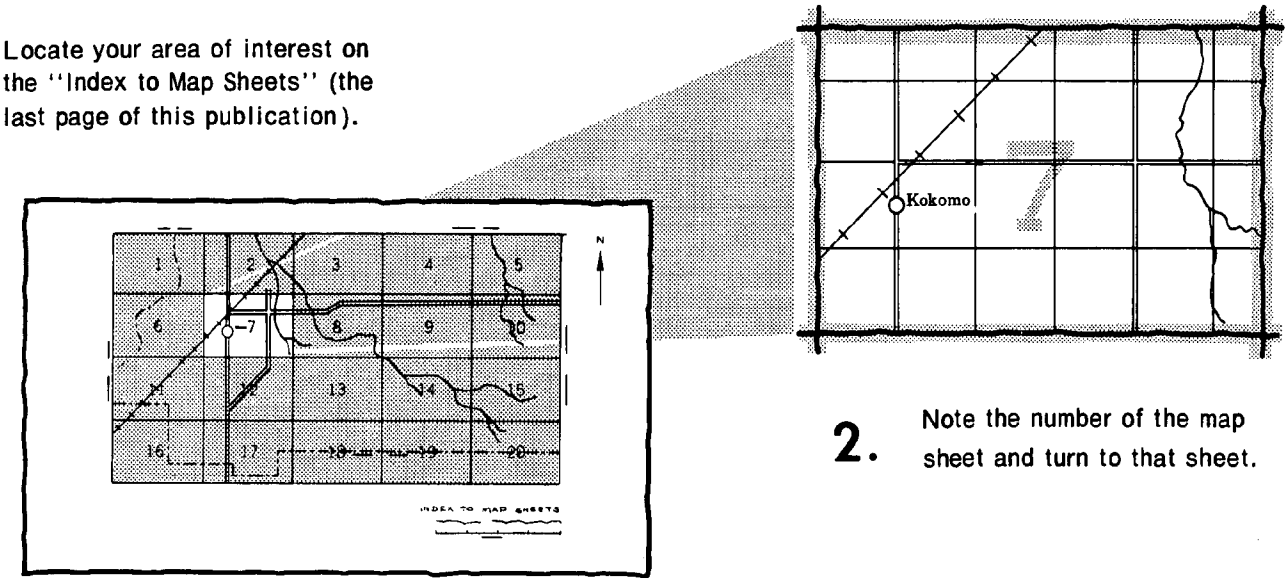

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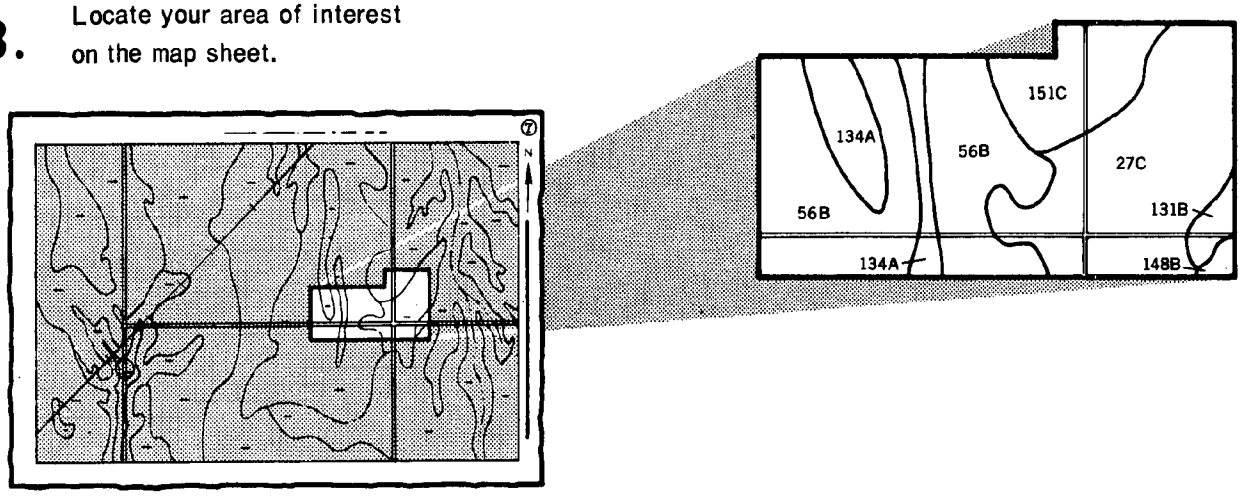

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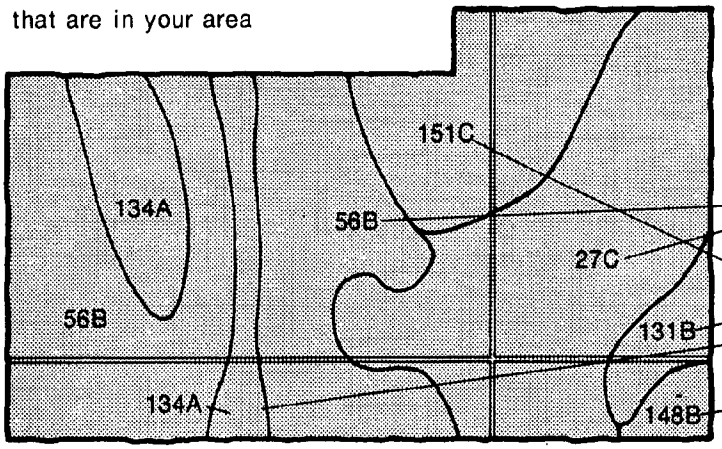

Symbols

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- 56B
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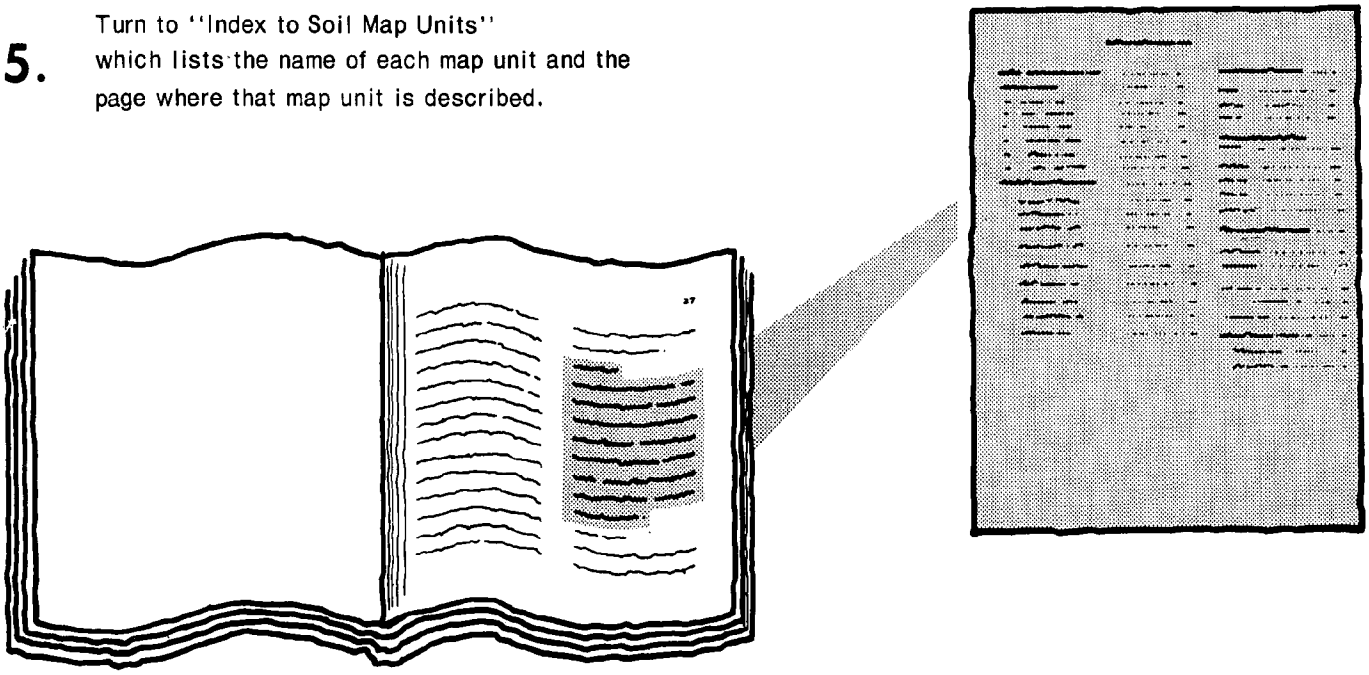
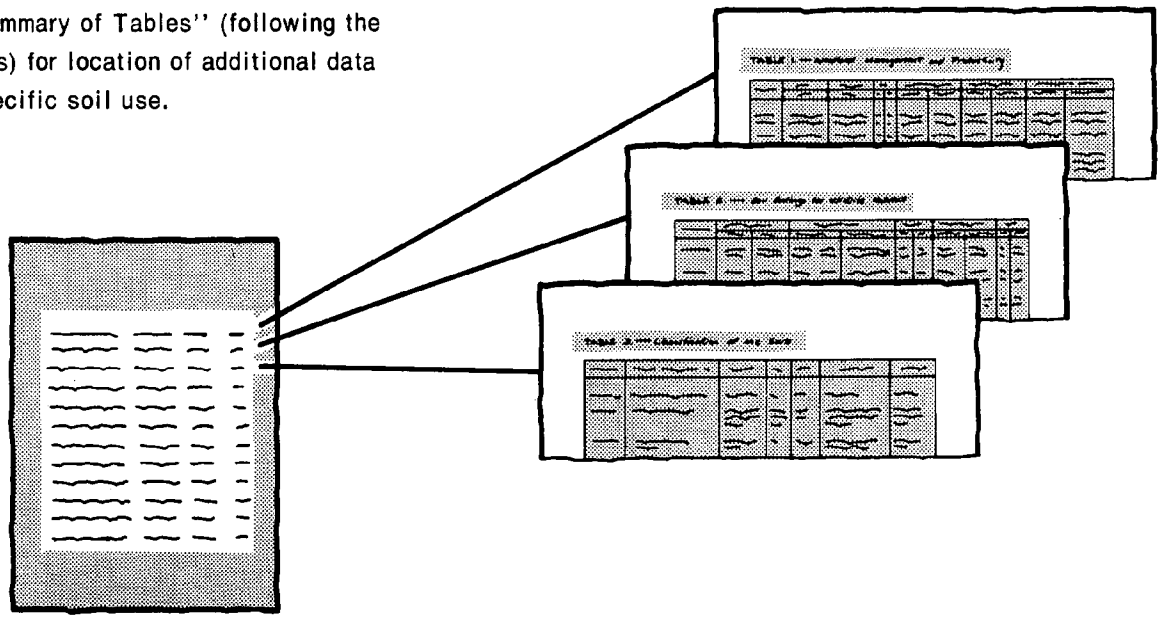
- 151C

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; for specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the states, generally the Agricultural Experiment Stations. 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 the period 1972-1977. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Minnesota Agricultural Experiment Station. It is part of the technical assistance furnished to the Upper Zumbro Soil and Water Conservation District. Financial assistance was provided by Olmsted County.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Contour stripcropping on Mt. Carroll soils.

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Foreword

The soil survey of Olmsted County, Minnesota, contains information that is basic to any land-use activity. It can help almost all land users.

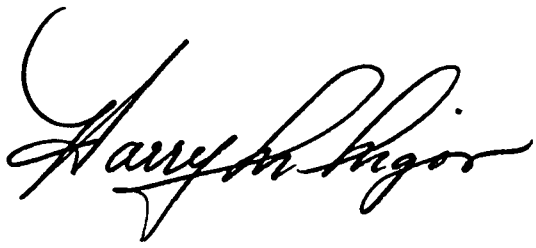
Farmers, foresters, and agronomists can use this survey to determine the potential of the soils for selected uses and the management practices required to produce food and fiber. Community planners, engineers, developers, builders, and home buyers can use it to plan use of land, select sites for construction, develop soil resources, and identify any special management practices that may be needed to insure proper performance of the soil. Conservationists, specialists in recreation, teachers, students, and specialists in wildlife management, waste disposal, or pollution control can use the survey to help understand, protect, and enhance the environment.

Many people assume that soils are generally alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding, they may be shallow to bedrock, or they may be too unstable to support buildings or roads. Soils that are very clayey or wet are poor sites for septic tank absorption fields, and soils that have a high water table are poor sites for buildings with basements or for underground installations.

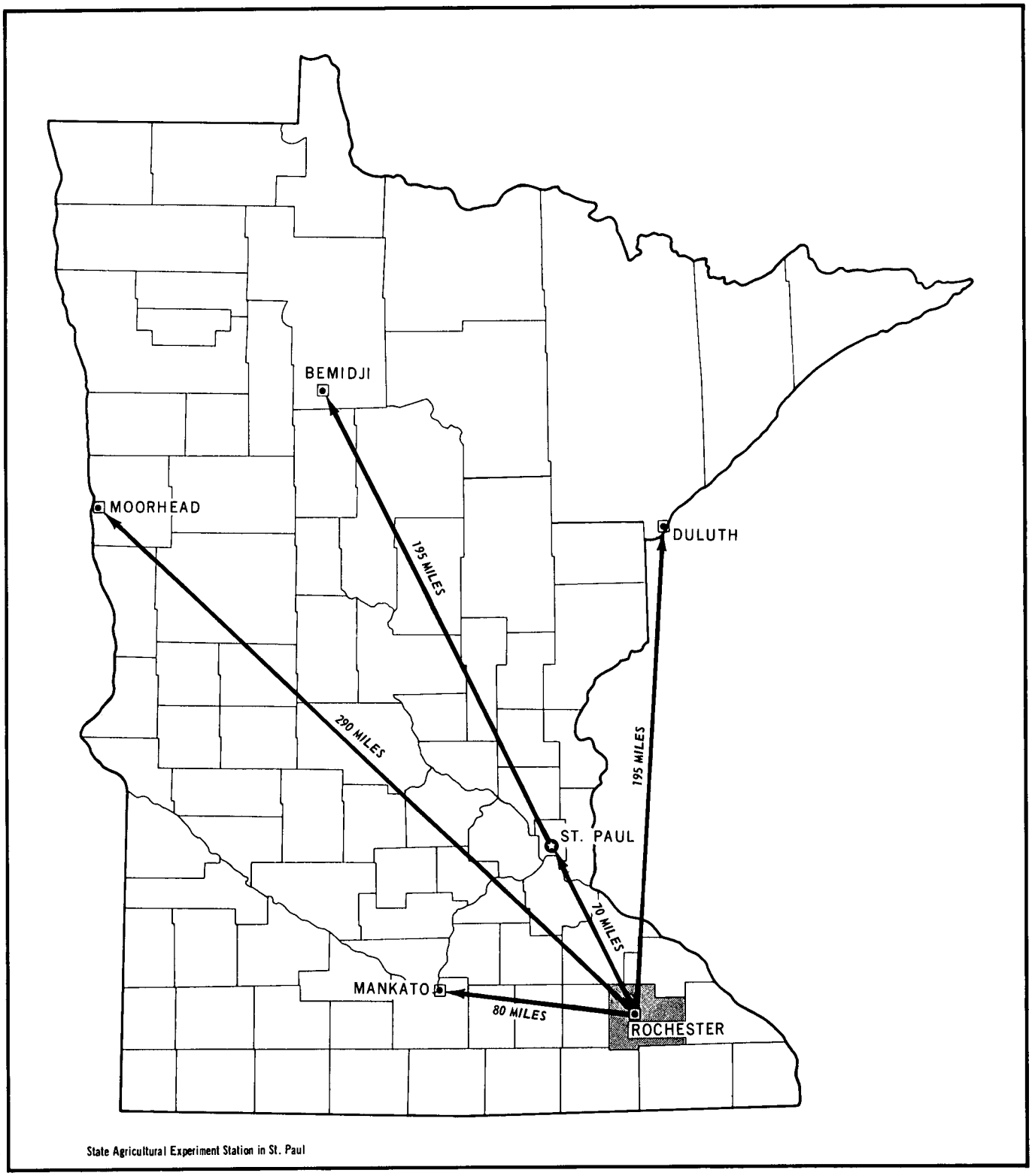
These and many other soil properties that affect land use are described in this soil survey. Of prime importance are the predictions of the potential of the soils for various land uses. Also highlighted are the limitations or hazards that affect a given land use, the improvements needed to overcome these limitations, and the impact that a selected land use will have on the environment.

The general soil map at the back of this publication shows the location of broad areas of soils. The detailed soil maps show the location of each kind of soil. The units on both kinds of maps are described under the headings "General soil map for broad land-use planning" and "Soil maps for detailed planning." Local offices of the Soil Conservation Service or the Cooperative Extension Service can provide further guidance on the effective use of this survey.

The widespread use of the information in this survey can help in the conservation and productive use of soil, water, and related resources.



Harry M. Major
State Conservationist
Soil Conservation Service



Location of Olmsted County in Minnesota.

Soil Survey of
Olmsted County
Minnesota

By George A. Poch, Soil Conservation Service

Fieldwork by George A. Poch, Carroll Carlson, Joseph Cummins, Gren Harms, David Aldeen, Jerome McCormick, Steven Hundley, Charles Saari, and Robert Lueth, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Minnesota Agricultural Experiment Station

General nature of the county

Olmsted County is in southeastern Minnesota. It has a total land area of 419,840 acres, of which 550 acres is water areas. According to the Olmsted County Planning Department, it had a population of 89,900 in 1976. Nearly 80 percent of this population was in or near Rochester, the county seat.

Farming is the leading occupation, and corn, soybeans, oats, and hay are the main cash crops. Dairy products and livestock are added sources of income in some areas.

Climate

By Bruce F. Watson, meteorologist, National Weather Service.

Olmsted County is in the interior climate region of North America. This region is characterized by a continental climate. Winters are cold, but summers are mild. Daily and weekly temperature extremes may vary greatly in any season. They vary the most in winter.

Table 1 gives data on temperature and precipitation for the survey area. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring.

In winter, temperature averages 16.2 degrees F (-8.8 degrees C) and the average daily minimum is 7.4 degrees F (-13.7 degrees C). In 2 years out of 10, the lowest temperature is -30 degrees F (-34.4 degrees C). The lowest temperature is -42 degrees F (-41 degrees C), which was observed at Rochester in January 1887.

In summer, the temperature averages 68.2 degrees F (20.1 degrees C) and the average daily maximum is 78.8 degrees F (26.0 degrees C). In 2 years out of 10, the highest temperature is 99 degrees F (37 degrees C). The highest temperature on record is 108 degrees F (42 degrees C), which was observed at Rochester on July 14, 1936.

Growing degree days, shown in table 1, 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 27.8 inches. Of this total, 20.2 inches, or 73 percent, falls during the warm months April through September and only 7.6 inches during the colder months. The heaviest 1-day rainfall on record is 5.26 inches, which was observed at Rochester on July 26, 1949. Thunderstorms occur on an average of 42 days per year, 8 of which are in June.

The average seasonal snowfall is 41 inches. About 8.9 inches falls in March, the snowiest month, and 8.7 inches in January. On an average of 90 days during the year, 1 or more inches of snow is on the ground. The greatest snow depth on record is 20 inches.

Relative humidity is lowest at midafternoon in May, when it averages about 47 percent, and highest at dawn in August, when it averages 86 percent. In December, the most humid month, it averages 79 percent and in May, the least humid, 65 percent.

The prevailing wind is out of the southeast quadrant about 30 percent of the time and out of the northwest quadrant 35 percent of the time. The average annual windspeed is 13 miles per hour. In April, the windiest month, the average speed is 15 miles per hour, and in August, the least windy month, it is 10 miles per hour. The strongest winds are usually from the northwest quadrant and the lightest from the northeast quadrant. Southwesterly winds are often brisk on hot summer days.

A strong windstorm strikes the county once or twice each decade, generally in the period October through May. Periods of high winds occur in summer, but they are generally brief and are limited to occasional high velocities (more than 50 miles per hour) during thunderstorms. Such winds result in local damage in scattered spots. At times during the period April through October, hail falls in scattered small areas.

On the summer solstice, the sun shines for 15 hours and 36 minutes, and on the winter solstice, it shines for 8 hours and 48 minutes. The percent of possible sunshine ranges from 73 percent in July to 36 percent in December. In winter it averages 46 percent, in spring 56 percent, in summer 69 percent, and in autumn 49 percent.

Physiography, relief, and drainage

Much of Olmsted County is characterized by a mature landscape that is dissected in a very intricate pattern by numerous drainageways leading to three major rivers. These are the Zumbto, Whitewater, and Root Rivers, which drain into the Mississippi River. The major stream valleys have very steep sides and are cut as deep as 300 feet in some areas. In stream valleys and some other areas, the landscape is highly dissected and outcrops of limestone, shale, and sandstone bedrock are very common.

The highest elevation, in the southwestern part of the county, is about 1,360 feet, and the lowest, on the bottom of stream valleys, is 850 feet.

History

Olmsted County was established on February 20, 1855, and was formally organized in 1858. Most of the early settlers were farmers. During the 1870's, however, the urban population began to outnumber the rural population.

During the construction of railroads in the 1860's, many areas that were far from any communities were farmed. After the railroads were built, wheat became the main crop grown for cash sale and for milling. Near the turn of the century, livestock numbers greatly increased, especially where markets were available. Dairy products were a significant part of the local economy by the 1920's, when 12 creameries, 3 ice cream factories, and 10 cheese factories were operating in the county. In recent years, the sale of livestock and livestock products has declined significantly.

The medical profession has had a significant impact on Olmsted County. More than 200,000 patients a year are treated in Rochester. As a result, hotel and restaurant service has grown rapidly. In recent years, the development of industry has resulted in an increase in population.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of woodland, engineers, planners, developers and builders, home buyers, and those seeking recreation.

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, the associations in this survey area.

Each association has a distinct pattern of soils and of 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 provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one association differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Areas dominated by soils formed in loamy and silty sediments and in the underlying loamy glacial till

Most of these areas are on broad uplands. The soils range from well drained to poorly drained and from nearly level to moderately steep.

1. Readlyn-Maxfield-Kenyon association

Nearly level and gently sloping, somewhat poorly drained, poorly drained, and moderately well drained loamy and silty soils on uplands

This association is on broad uplands that have low relief and are cut by many long, narrow drainageways. The summits of low knolls and ridges are flat and very broad in some areas but are convex and narrow in others. The sides of the drainageways are concave to convex. Slopes are dominantly 0 to 6 percent.

This association makes up about 4 percent of the survey area. It is about 20 percent Readlyn and similar soils, 20 percent Maxfield and similar soils, 15 percent Kenyon soils, and 45 percent minor soils (fig. 1).

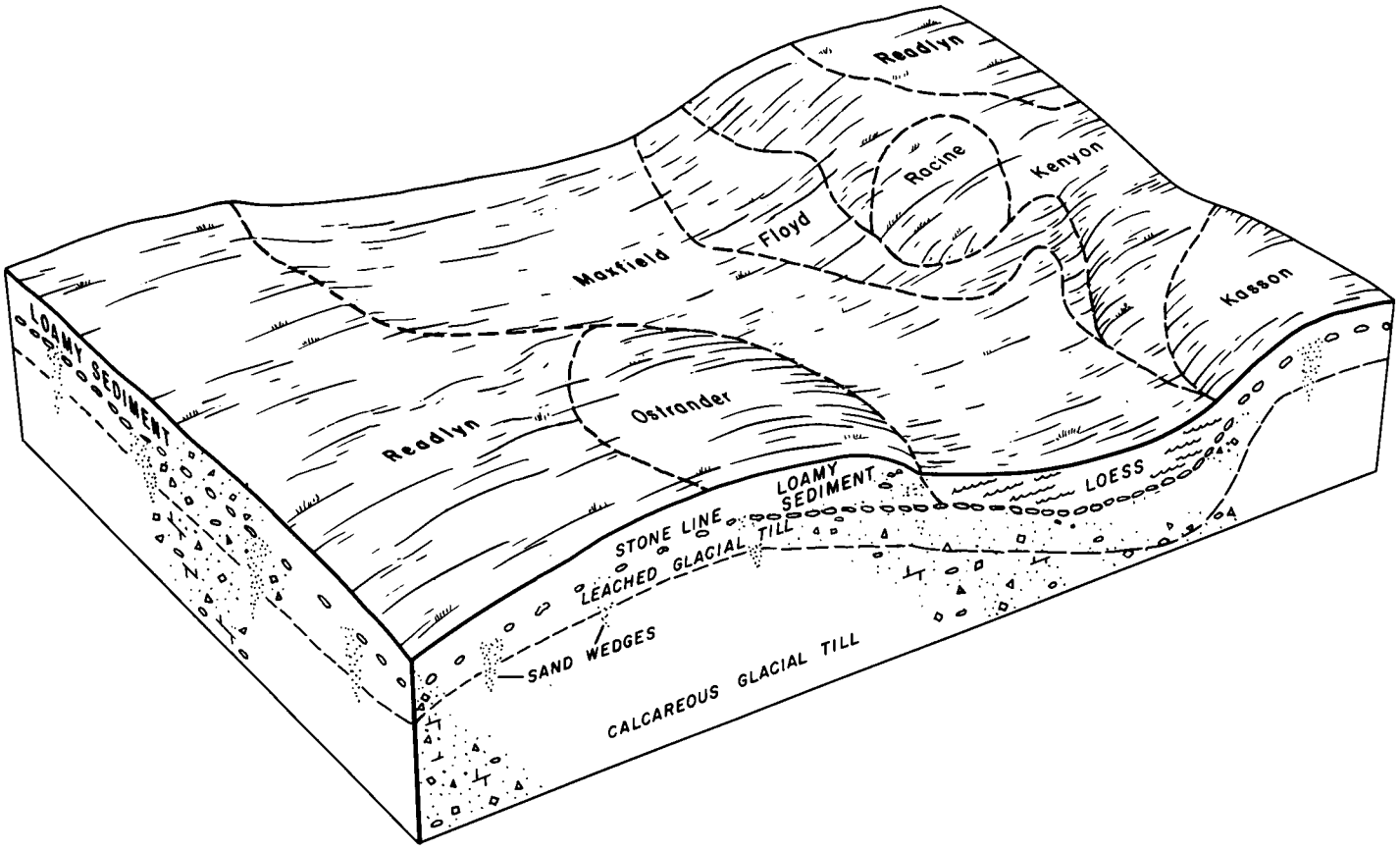


Figure 1.—Pattern of soils and underlying material in the Readlyn-Maxfield-Kenyon association.

The somewhat poorly drained Readlyn soils are on the flatter parts of summits. They typically have a surface layer of black and very dark grayish brown loam and a subsoil of dark grayish brown and yellowish brown loam.

The poorly drained Maxfield soils are in drainageways and on head slopes. They typically have a black and very dark gray silty clay loam surface layer. The subsoil is grayish brown silty clay loam and silt loam over yellowish brown loam.

The moderately well drained Kenyon soils are on the summits and sides of low knolls and hills. They typically have a very dark brown loam surface layer and a very dark grayish brown clay loam subsurface layer. The subsoil is yellowish brown clay loam over yellowish brown and brown loam.

The minor soils in this association are the somewhat poorly drained loamy Floyd soils on head slopes above drainageways, the moderately well drained loamy Kasson soils on summits, the very poorly drained silty Kato and Marshan soils in drainageways and on terraces, the well drained loamy Ostrander soils on summits and side slopes above drainageways, and the well drained and moderately well drained loamy Racine soils on side slopes and summits.

Most of this association is farmed. Some undrained areas are pastured. Kato and other very wet minor soils could be developed for wetland wildlife habitat.

The major soils in this association are well suited to corn, soybeans, and small grain. A subsurface drainage system lowers the water table and improves the effective rooting depth in the Readlyn and Maxfield soils. Leaving crop residue on the surface reduces the risk of erosion and allows for the maximum intake of rainfall. In some areas of the Maxfield soils, slopes are long and smooth enough for contour farming or terracing.

Suitability is fair to poor for building site development on the Readlyn and Maxfield soils because of a seasonal high water table. The Kenyon soils are well suited to building site development, but they are severely limited as septic tank absorption fields because they are moderately slowly permeable in the underlying material.

2. Racine-Floyd-Maxfield association

Nearly level to moderately steep, well drained to poorly drained silty soils on uplands and in upland drainageways

This association is on dissected uplands where local relief between drainageways and summits is about 20 to 50 feet. Most of the summits are narrow and convex and are oriented in the same direction as the adjoining side slopes and long, narrow drainagways. The drainageways are flat to somewhat depressional. Slopes range from 0 to 18 percent.

This association makes up about 21 percent of the survey area. It is about 20 percent Racine and similar soils, 10 percent Floyd soils, 8 percent Maxfield soils, and 62 percent minor soils.

The well drained and moderately well drained Racine soils are on summits and side slopes. They typically have a surface layer of very dark brown silt loam and a subsurface layer of dark grayish brown silt loam. The subsoil is dark yellowish brown clay loam over yellowish brown sandy clay loam.

The somewhat poorly drained Floyd soils are on head slopes above drainageways. The surface layer is typically black silt loam and clay loam over very dark brown silt loam and very dark grayish brown loam. The subsoil is dark grayish brown, olive brown, and yellowish brown loam.

The poorly drained Maxfield soils are in drainageways and on head slopes. They typically have a black and very dark gray silty clay loam surface layer. The subsoil is grayish brown silty clay loam and silt loam over yellowish brown loam.

The minor soils in this association are the well drained, gently sloping and sloping Dowagiac soils; the excessively drained Lilah soils on side slopes; the very poorly drained Kato, Marshan, and Otter soils on low terraces and in drainageways; the moderately well drained Kasson soils on the summits of low hills; the well drained Ostrander soils on summits and side slopes; and the very poorly drained Palms soils on toe slopes.

Most of this association is farmed. Some of the wet areas in drainageways have been drained with tile and are cropped. Others are undrained and are pastured. Some areas of the wetter soils are suitable as wetland wildlife habitat.

The major soils are well suited to corn, small grain, and soybeans. The main concerns of management are controlling erosion on the gently sloping to moderately steep Racine soils and internal drainage in the wetter Floyd and Maxfield soils. Leaving crop residue on the surface helps to control erosion and allows for the maximum intake of rainfall. In some areas of the Racine soils, slopes are long and smooth enough for contour farming or terracing.

Suitability is good to fair for building site development and sanitary facilities on the Racine soils. The slope is a limitation in some areas. The Floyd and Maxfield soils are poorly suited to building site development and sanitary facilities because they are wet.

Areas dominated by soils formed in a loamy mantle and in the underlying clayey residuum over bedrock

These areas are on uplands. The soils are well drained and nearly level to sloping.

3. Rockton-Channahon-Atkinson association

Nearly level to sloping, well drained loamy soils on uplands

This association is generally on broad uplands that have local relief of 5 to 20 feet and are dissected by deep drainageways. Slopes are dominantly 0 to 12 percent.

This association makes up about 13 percent of the survey area. It is about 35 percent Rockton and similar soils, 25 percent Channahon soils, 12 percent Atkinson soils, and 28 percent minor soils (fig. 2).

Rockton soils are on head slopes above drainageways and on the sloping parts of summits and side slopes. They typically have a very dark brown loam surface layer and a very dark grayish brown loam subsurface layer. The subsoil is dark brown and dark yellowish brown loam, sandy clay loam, and clay.

Channahon soils are on rises and knolls and on side slopes. They typically have a very dark brown and very dark grayish brown loam surface layer and a dark brown loam subsoil.

Atkinson soils are on summits. They typically have a surface layer of very dark brown and very dark grayish brown loam and a subsoil of dark brown and yellowish brown loam and clay loam.

The minor soils in this association are the well drained Lamont, Ostrander, Racine, and Waucoma soils on summits and side slopes, the somewhat excessively drained Sogn and excessively drained Brodale soils on shoulders and side slopes, and the moderately well drained Chaseburg soils along upland drainageways.

Most of this association is used for corn, soybeans, small grain, and alfalfa. The steeper areas are permanent pasture or woodland. The main concerns in managing cropland are a hazard of erosion in the steeper areas, droughtiness, and a restricted root zone. The soils are generally well suited to pasture.

A restricted depth to bedrock is the main limitation if the Channahon and Rockton soils are used as sites for buildings or sanitary facilities. Also, the effluent from sanitary facilities can pollute underground water supplies.

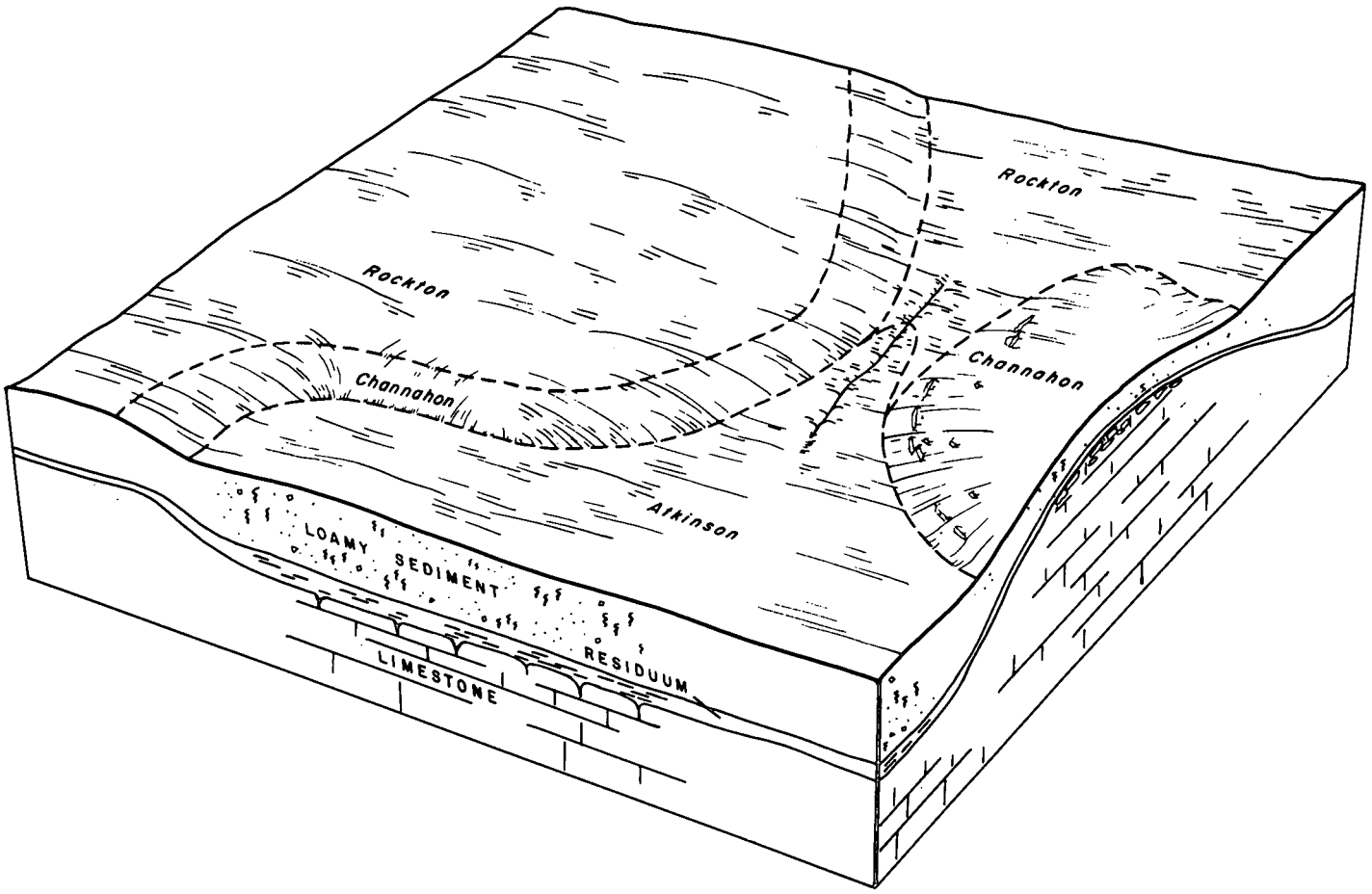


Figure 2.—Pattern of soils and underlying material in the Rockton-Channahon-Atkinson association.

Areas dominated by soils formed in loess

Most of these areas are on broad uplands. The soils range from well drained to very poorly drained and from nearly level to very steep.

4. Mt. Carroll-Otter-Joy association

Nearly level to moderately steep, well drained, very poorly drained, and somewhat poorly drained silty soils on uplands and in upland drainageways

This association is in drainageways and on summits. Local relief is about 10 to 50 feet. The summits are typically narrow and are oriented in the same direction as the adjoining side slopes and long, narrow drainageways. The side slopes are typically wide and concave. The drainageways are flat or somewhat depressional. Slopes range from 0 to 25 percent.

This association makes up about 19 percent of the survey area. It is about 45 percent Mt. Carroll soils, 14 percent Otter soils, 8 percent Joy soils, and 33 percent minor soils (fig. 3).

The well drained Mt. Carroll soils are on summits and side slopes. They typically have a very dark grayish brown silt loam surface layer and a dark brown silt loam subsurface layer. The subsoil is dark yellowish brown and yellowish brown silt loam and silty clay loam.

The very poorly drained Otter soils are in narrow drainageways. They typically have a surface layer of very dark gray and black silt loam and silty clay loam.

The somewhat poorly drained Joy soils are in drainageways. They typically have a surface layer of black silt loam and a subsoil of dark grayish brown and olive brown silt loam.

The minor soils in this association are the poorly drained Garwin soils in drainageways, the somewhat poorly drained Littleton soils on the lower part of side slopes and on head slopes, and the well drained Port Byron soils on upland summits.

Most of this association is farmed. The major soils are well suited to hay and to cultivated crops, such as corn, soybeans, and small grain. Erosion is the main concern of management, especially in the more sloping areas of

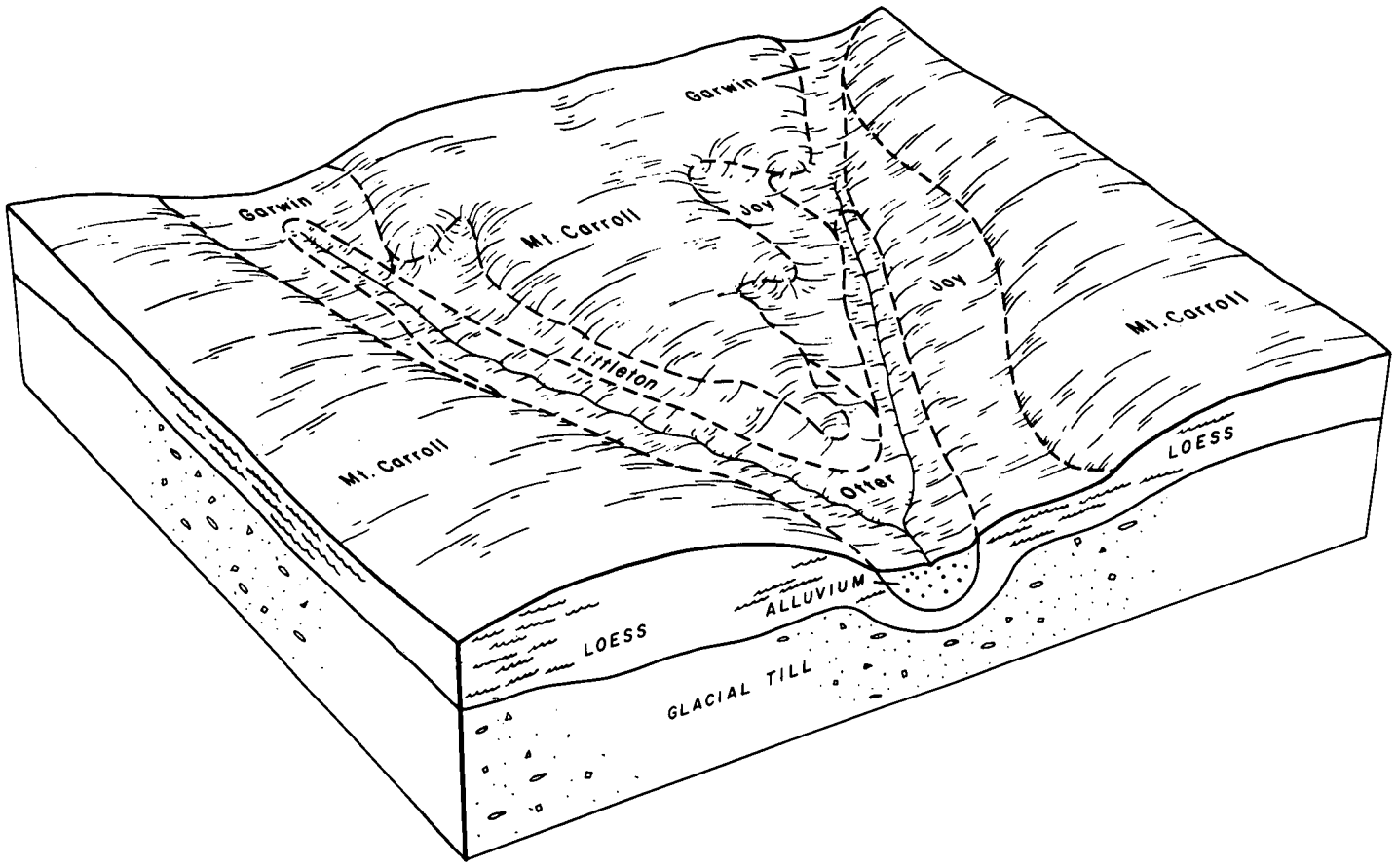


Figure 3.—Pattern of soils and underlying material in the Mt. Carroll-Otter-Joy association.

the Mt. Carroll soils on side slopes. Tile drainage is needed in the Joy and Otter soils to improve rooting depth and provide earlier access to fields. Otter soils are generally suitable for wetland wildlife habitat.

The Mt. Carroll soils are well suited to building site development and sanitary facilities. The Joy and Otter soils, however, are poorly suited. They have a high water table, which interferes with the installation and functioning of most sanitary facilities. Also, the Otter soils are frequently flooded.

5. Port Byron-Lindstrom-Garwin association

Nearly level to moderately steep, well drained and poorly drained silty soils on uplands

This association is in drainageways and on summits where local relief is low. The summits are low and broad. Slopes range from 0 to 15 percent.

This association makes up about 8 percent of the survey area. It is about 50 percent Port Byron soils, 15 percent Lindstrom soils, 15 percent Garwin soils, and 20 percent minor soils.

The well drained Port Byron soils are on summits and side slopes. They typically have a very dark brown and very dark grayish brown silt loam surface layer and a dark brown, dark yellowish brown, and yellowish brown silt loam subsoil.

The well drained Lindstrom soils are on foot slopes and head slopes above drainageways. They typically have a black and very dark grayish brown silt loam surface layer and a dark brown and yellowish brown silt loam subsoil.

The poorly drained Garwin soils are in drainageways. They typically have a black silty clay loam surface layer and a dark grayish brown, grayish brown, and olive gray silty clay loam and silt loam subsoil.

The minor soils in this association are the well drained Mt. Carroll and Timula soils on summits and side slopes and the somewhat poorly drained Joy, moderately well drained Chaseburg, and very poorly drained Otter soils in drainageways.

Most of this association is used for corn and soybeans. Small grain and hay are grown in the more sloping areas. The major soils are well suited to corn, soybeans, and small grain. A subsurface drainage system can lower the water table and improve the effective rooting depth in the Garwin soils. Leaving crop residue on the surface reduces the risk of erosion and allows for the maximum intake of rainfall. In some areas of the Port Byron and Lindstrom soils, slopes are long and smooth enough for contour farming or terracing.

The Port Byron and Lindstrom soils are well suited to building site development and sanitary facilities. The Garwin soils, however, are poorly suited because of wetness, low strength, and frost action.

6. Timula-Port Byron association

Nearly level to very steep, well drained silty soils on uplands

This association is on summits and in drainageways. Local relief between the summits and the low lying drainageways is as much as 100 feet. The surface is convex on the summits. Slopes range from 0 to 30 percent.

This association makes up about 3 percent of the survey area. It is about 65 percent Timula soils, 20 percent Port Byron soils, and 15 percent minor soils.

Timula soils are on summits and side slopes. They typically are silt loam throughout. The surface layer is very dark grayish brown and the subsoil yellowish brown.

Port Byron soils also are on summits and side slopes. They typically have a very dark brown and very dark grayish brown silt loam surface layer and a dark brown, dark yellowish brown, and yellowish brown silt loam subsoil.

The minor soils in this association are the moderately well drained Arenzville soils on bottom land along drainageways, the moderately well drained Chaseburg soils in drainageways, the well drained Lindstrom soils on head slopes and foot slopes, the well drained Marlean soils on side slopes, and the well drained Mt. Carroll soils on summits.

Most of this association is cropland. Areas that are too steep or too frequently flooded for cropping are permanent pasture. Some scenic areas are used for parks.

In the less sloping areas, the major soils are well suited to corn, soybeans, and small grain. If the soils are cultivated, the main concern of management is erosion in the steeper areas. Leaving crop residue on the surface, terracing, and farming on the contour help to control runoff and erosion.

The major soils are generally well suited to building site development and sanitary facilities, but erosion is a hazard. The slope is a severe limitation in some areas. Lateral seepage is a concern if septic tank absorption fields are installed in the more sloping areas.

7. Mt. Carroll-Marlean-Arenzville association

Nearly level to very steep, well drained and moderately well drained silty soils on uplands and flood plains

This association is in deeply dissected areas that have many narrow ravines. Perennial or intermittent streams are along the floor of the ravines. Local relief between the summits and the bottoms of stream valleys is as much as 400 feet.

This association makes up about 21 percent of the survey area. It is about 35 percent Mt. Carroll soils, 10 percent Marlean soils, 8 percent Arenzville and similar soils, and 47 percent minor soils (fig. 4).

The well drained Mt. Carroll soils are on summits and side slopes. They typically have a very dark grayish brown silt loam surface layer and a dark brown silt loam subsurface layer. The subsoil is dark yellowish brown and yellowish brown silt loam and silty clay loam.

The well drained Marlean soils are on side slopes. They typically have a very dark grayish brown silty clay

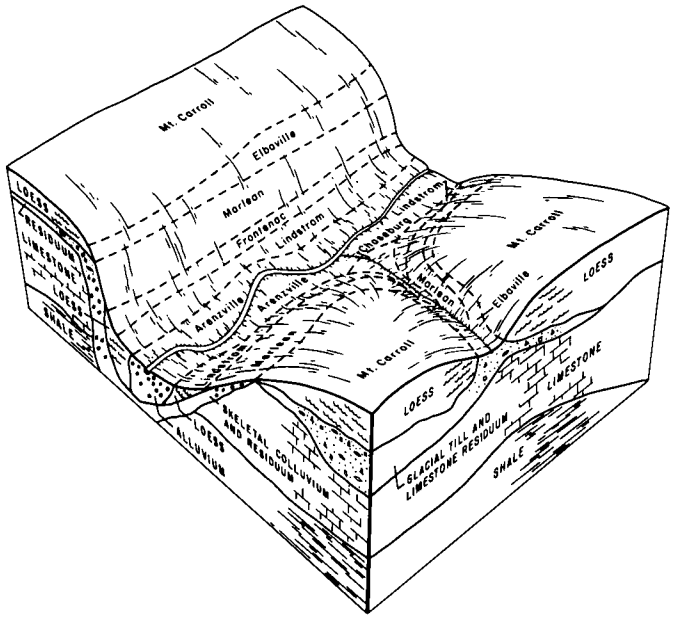


Figure 4.—Pattern of soils and underlying material in the Mt. Carroll-Marlean-Arenzville association.

loam surface layer and a dark brown flaggy silty clay loam subsoil.

The moderately well drained Arenzville soils are on flood plains. They typically are silt loam throughout. They are very dark grayish brown in the upper part and black, dark brown, and yellowish brown in the lower part.

The minor soils in this association are the well drained Frankville soils on summits and side slopes, the well drained Dorerton and Elbaville soils on side slopes and shoulders, the well drained Lindstrom and Frontenac soils on foot slopes, the moderately well drained Chaseburg soils in drainageways, the poorly drained Root soils on flood plains, and the excessively drained Brodale soils on south- to west-facing side slopes.

In the less sloping areas, the major soils are well suited to cultivated crops. Most areas are used for corn, soybeans, and small grain. If the soils are cultivated, the main concern of management is erosion in the steeper areas. Leaving crop residue on the surface, terracing, and contour stripcropping help to control runoff and erosion.

The less sloping areas of Mt. Carroll soils are well suited to building site development and sanitary facilities. The more sloping areas of Mt. Carroll soils and all areas of Marlean soils, however, have severe limitations. Erosion is the main concern if these areas are developed as sites for buildings or sanitary facilities. Lateral seepage is a concern if septic tank absorption fields are installed in the more sloping areas. Arenzville soils are poorly suited to building site development and sanitary facilities because they are wet and subject to flooding.

Areas dominated by soils formed in a sandy, silty, or loamy mantle and in the underlying sandy material

These areas are on terraces and outwash plains. The soils range from excessively drained to poorly drained and from nearly level to very steep.

8. Dickinson-Plainfield-Kalmarville association

Nearly level to very steep, well drained, somewhat excessively drained, excessively drained, and poorly drained soils that are loamy and sandy on outwash terraces and silty on flood plains

This association is on terraces, foot slopes, and flood plains in stream valleys. Slopes range from 0 to 30 percent.

This association makes up about 3 percent of the survey area. It is about 30 percent Dickinson soils, 25 percent Plainfield soils, 15 percent Kalmarville soils, and 30 percent minor soils.

The well drained and somewhat excessively drained Dickinson soils are on outwash terraces and foot slopes. They typically have a very dark grayish brown and dark brown sandy loam surface layer and a dark brown, dark yellowish brown, and yellowish brown sandy loam and sand subsoil.

The excessively drained Plainfield soils are on stream terraces. They typically have a very dark brown loamy sand surface layer and a dark grayish brown loamy sand subsurface layer. The subsoil is dark brown sand.

The poorly drained Kalmarville soils are on flood plains along streams. They typically have a surface layer of very dark gray silt loam. The underlying material is dark gray sand.

The minor soils in this association are the well drained Waukee, somewhat poorly drained Hoopeston, and very poorly drained Marshan soils on stream terraces and the very poorly drained Otter soils on flood plains.

Most of this association is farmed. Corn, small grain, and alfalfa are the major crops. Suitability is fair for pasture and cultivated crops. The main concerns in managing cropland are a low avalable water capacity, a severe hazard of soil blowing, and low natural fertility.

The Plainfield and Dickinson soils are well suited to building site development. The main concerns on building sites are the susceptibility to frost heave and the seasonal high water table in the Kalmarville soils and in the wet minor soils. The Plainfield and Dickinson soils are poorly suited to sanitary facilities. The effluent can pollute underground water supplies. The Kalmarville soils are poorly suited to sanitary facilities because they are wet and subject to flooding.

9. Waukee-Radford-Spillville association

Nearly level and gently sloping, well drained, somewhat poorly drained, and moderately well drained soils that are loamy on outwash terraces and silty on flood plains

This association is on terraces and flood plains along streams or the major rivers. Slopes range from 0 to 6 percent.

This association makes up about 8 percent of the survey area. It is about 27 percent Waukee soils, 14 percent Radford soils, 8 percent Spillville and similar soils, and 51 percent minor soils.

The well drained Waukee soils are on stream terraces. They typically have a very dark brown and very dark grayish brown loam surface layer and a dark brown to yellowish brown loam and sandy loam subsoil.

The somewhat poorly drained Radford soils are on flood plains along streams. They typically have a surface layer of very dark gray silt loam. The underlying material also is very dark gray silt loam. Below this is a buried soil.

The moderately well drained Spillville soils are on flood plains. They typically have a black and very dark brown silt loam and loam surface layer and a dark grayish brown and grayish brown loam subsoil.

The minor soils in this association are the somewhat excessively drained Dickinson and somewhat poorly drained Lawler soils on stream terraces and the moderately well drained Becker, poorly drained Sawmill, and very poorly drained Marshan soils on flood plains.

Most of this association is used for corn, soybeans, small grain, and alfalfa. Some areas are pasture or woodland. The main management concerns are the droughtiness of the Waukee soils and the wetness of the Radford and Spillville soils.

The Waukee soils are well suited to building site development but are poorly suited to sanitary facilities. The effluent from sanitary facilities installed in the Waukee soils can pollute undergrond water supplies. The Spillville and Radford soils are poorly suited to building site development and sanitary facilities because they are wet and subject to flooding.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils having profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Oronoco series, for example, was named for the town of Oronoco in Olmsted County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Mt. Carroll silt loam, 6 to 12 percent slopes, eroded, is one of several phases within the Mt. Carroll series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Brodale-Bellechester complex, 25 to 60 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits, gravel, is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

2A—Ostrander silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is upslope from drain-

ageways on glacial uplands. Slopes are plane and slightly convex. Most areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown silt loam about 13 inches thick. The subsoil is about 37 inches thick. The upper 15 inches is dark yellowish brown silt loam. The lower 22 inches occurs as strata of dark yellowish and yellowish brown, friable loam and thin layers of sandy loam. The underlying material to a depth of about 60 inches is brown loam. In places brown, firm loam glacial till is at a depth of 50 inches or more. In wooded areas a dark grayish brown subsurface layer is below the surface layer.

Included with this soil in mapping are the somewhat poorly drained Floyd soils, which make up as much as 15 percent of some areas. These soils formed in material similar to that in which the Ostrander soil formed. They are typically downslope from this soil, in lower lying positions along drainageways.

Water and air move through the Ostrander soil at a moderate rate. Runoff is medium, and available water capacity is high. Reaction is neutral in the surface layer and slightly acid to strongly acid in the subsoil. Organic matter content is high in the surface layer. The supply of available potassium and phosphorus is medium in the subsoil.

Most areas are cultivated. This soil has good potential for cultivated crops, pasture, and hay and for sanitary facilities and building site development.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and such legumes as alfalfa, birdsfoot trefoil, and alsike clover grow well. Rotation grazing or deferred grazing keeps the more productive forage plants dominant.

This soil is well suited to building site development and sanitary facilities. Onsite investigation is needed to avoid installing septic tank absorption fields on the less desirable included soils.

The capability class is I.

2B—Ostrander loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on summits and side slopes on glacial drift uplands. The surface is plane to slightly convex, and slopes are 100 to 400 feet long. Most areas range from 3 to 50 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 14 inches thick. The subsoil is dark yellowish brown, yellowish brown, and dark brown loam about 34 inches thick. It is mottled in the lower part. The underlying material to a depth of 70 inches or more is firm, brown, mottled loam. In wooded areas a dark grayish brown subsurface layer is below the surface layer.

Included with this soil in mapping are the somewhat poorly drained Floyd soils on head slopes above drainageways. These soils make up about 15 percent of most areas.

Permeability is moderate in the Ostrander soil, and available water capacity is high. Runoff is medium. Unless limed, the surface layer is slightly acid or medium acid. The subsoil ranges from strongly acid to neutral. The content of organic matter is high. The supply of available phosphorus and potassium is medium.

Most areas are cultivated. This soil has good potential for cultivated crops, pasture, and hay and for sanitary facilities and building site development.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of water. Some slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding the pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Proper stocking rates, pasture rotation, and deferred grazing keep the more productive grasses dominant.

This soil is well suited to building site development and sanitary facilities. Onsite investigation is needed to avoid installing septic tank absorption fields on the less desirable included soils.

The capability subclass is IIe.

11C—Sogn loam, 4 to 12 percent slopes. This gently sloping and sloping, somewhat excessively drained soil is on south- and west-facing, convex side slopes. It is very shallow over limestone bedrock. Few to many limestone fragments and flagstones are on the surface (fig. 5). Areas are about 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. Below this is a layer of broken limestone fragments about 4 inches thick. The underlying material is hard limestone.

Included with this soil in mapping are Channahon soils, which make up about 15 percent of some areas. These soils contain more clay below the surface layer than the Sogn soil. They are in similar positions on the landscape.

Permeability is moderate in the Sogn soil, and available water capacity is very low. Organic matter content is moderate, and natural fertility is low. The surface layer is mildly alkaline or moderately alkaline. The root zone is 20 inches or less thick.

Most areas are pastured. This soil has fair potential for pasture. It has poor potential for cultivated crops and fair to poor potential for hay. It has poor potential for sanitary facilities and building site development.

Figure 5.—Areas of light colored Sogn soils on knolls. Limestone fragments are on the surface.

Suitability is fair for pasture. The less productive grasses, such as Kentucky bluegrass, dominate in overgrazed pastures. These pastures can be improved by introducing legumes, such as birdsfoot trefoil and alfalfa, or by planting a mixture of alfalfa and bromegrass. The soil is highly susceptible to erosion if the pasture is overgrazed. Pasture rotation and controlled grazing reduce the risk of erosion. Applications of lime and fertilizer improve the productivity of pastures.

This soil is poorly suited to building site development and sanitary facilities because it is gently sloping and sloping and is shallow over bedrock. Excavating is difficult. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is VIIs.

16—Arenzville silt loam. This nearly level, moderately well drained soil is on narrow flood plains along streams. It is frequently flooded for brief periods. Areas are long and 100 to 500 feet wide. They range from 5 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. This layer is underlain by about 23 inches of very dark grayish brown silt loam that has thin, grayish brown strata. Below this is a buried soil. The upper 4 inches of this buried soil is black silt loam, and the subsoil to a depth of 60 inches is dark brown and yellowish brown silt loam. In some areas depth to the buried soil is more than 40 inches.

Water and air move through this soil at a moderate rate. Available water capacity is high. Runoff is slow. Natural fertility and the supply of available phosphorus and potassium are medium. The surface layer and subsoil are medium acid to neutral. Organic matter content is moderate in the upper layers and high in the upper part of the buried soil. The seasonal high water table is 3 to 6 feet below the surface.

Most areas are farmed. This soil has good potential for cultivated crops, hay, pasture, and woodland. It has poor potential for sanitary facilities and building site development.

This soil is well suited to corn and soybeans, but floodwater can damage crops. A subsurface drainage system is needed. Control of weeds is needed in areas where floodwater spreads seeds. Small grain tends to lodge because of the added moisture. Some upstream flood control structures are needed to keep meandering streams from cutting into cropland. If the soil is plowed in the fall, clods break up during the winter and a seedbed can be prepared earlier in the spring.

This soil is well suited to pasture. A species such as Kentucky bluegrass is naturally suitable, but productivity is low because of summer dormancy. Pastures can be improved by introducing legumes, such as birdsfoot trefoil and alfalfa, or by planting water tolerant grasses, such as Garrison creeping foxtail. Grazing should be restricted during wet periods.

This soil is well suited to woodland. Tree seedlings survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, or by spraying, cutting, or girdling. The hazard of flood damage is minimal on woodland.

Because of the frequent flooding and the wetness, this soil is unsuitable as a site for buildings and sanitary facilities. Building local roads above the water table helps to prevent the damage caused by frost action.

The capability subclass is IIw.

19—Chaseburg silt loam. This nearly level, moderately well drained soil is in drainageways on loess-covered uplands. It is frequently flooded. Areas are long and narrow and are about 2 to 10 acres in size. In some areas small gullies have formed.

The upper 51 inches occurs mostly as recent sediments. Typically, the surface soil is very dark grayish brown silt loam about 15 inches thick. The next 36 inches is very dark grayish brown and very dark gray silt loam. Below this to a depth of 60 inches or more is a buried soil. The buried surface layer is very dark grayish brown silt loam, and the buried subsoil is dark yellowish brown silt loam. In places the soil has many strata of fine sandy loam.

Water and air move through this soil at a moderate rate. Available water capacity is high. Reaction is slightly acid or neutral throughout the soil. The supply of phosphorus and potassium is medium, and organic matter content is moderate. Runoff is slow or medium. The seasonal high water table is at a depth of 3 to 6 feet.

Most areas are pastured or are idle. Many of the areas within cultivated fields are grassed waterways. This soil has good potential for pasture and fair potential for hay and woodland if flooding is controlled. It has poor potential for cultivated crops, sanitary facilities, and building site development.

This soil is well suited to pasture. Kentucky bluegrass can be easily established naturally. A higher quantity of better quality forage can be obtained if legumes, such as alfalfa and birdsfoot trefoil, are seeded by methods that do not disturb the sod. Water tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, are well suited. Weeds, such as thistles and other broadleaves, are constantly carried in by floodwater. Controlling these weeds is difficult. It is essential prior to renovation. The pastures should not be grazed when too wet.

This soil is well suited to woodland. Tree seedlings survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, or by spraying herbicides, cutting, or girdling.

Buildings and sanitary facilities should not be constructed on this soil because of the wetness and the flooding. Because of the flooding, the soil is unsuitable as a recreation area, such as a campsite or a playground.

The capability subclass is Vw.

23—Skyberg silt loam. This nearly level, somewhat poorly drained soil occurs as plane to slightly concave areas above drainageways on broad uplands. Areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is grayish brown silty clay loam, the middle part is yellowish brown fine sandy loam, and the lower part is yellowish brown, very firm loam. The underlying material to a depth of about 70 inches is brown loam. In places the lower part of the subsoil is stratified with loam and sandy loam and with thin layers of sand.

Permeability is moderately slow. Runoff is slow. Available water capacity is high. The subsoil is strongly acid or very strongly acid. Organic matter content is moderate. The supply of available phosphorus is medium and the supply of available potassium low. The seasonal high water table is at a depth of 1 foot to 3 feet.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, and woodland. It has poor potential for building site development and most sanitary facilities.

If drained, this soil is well suited to cultivated crops. The main limitation is wetness, which restricts the depth to which roots can penetrate. The main management needs are providing artificial drainage and keeping the soil in good tilth. Returning crop residue to the soil helps to keep the soil in good tilth. Fall tillage allows the soil to warm earlier in the spring and allows for earlier seedbed preparation. Applications of lime generally are beneficial, especially if the lime can be worked into the subsoil. In places waterways are needed to divert runoff.

This soil is well suited to pasture and hay. Reseeding with suitable forage plants improves the productivity of pastures. Forage species, such as red clover, alsike clover, and timothy, generally can withstand the acidity of the soil. Applications of lime are needed if alfalfa is grown. Grazing should be controlled and delayed when the surface layer is wet.

This soil is well suited to woodland. The quality of timber in many areas can be improved by pruning and thinning. Spraying or cutting controls competition from herbs and small brush. The soil is likely to be very soft early in spring. As a result, work in woodlots should be delayed until fall or early in winter.

This soil is poorly suited to building site development and sanitary facilities. The high water table interferes with excavations, results in wet basements, and prevents the proper functioning of septic tank absorption fields. If possible, tile should be placed around basements. The water table also results in a high potential for frost action. Roads, parking lots, sidewalks, and driveways should be constructed above the water table. The effluent from sanitary facilities can pollute ground water supplies.

The capability subclass is IIIw.

24—Kasson silt loam. This very gently sloping, moderately well drained soil generally is on slightly convex to plane summits on broad glacial uplands. In some areas it is along drainageways. Areas range from 2 to 40 acres in size.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is about 46 inches thick. The upper 13 inches is dark brown and brown silt loam and silty clay loam, and the lower 33 inches is yellowish brown, light brownish gray, and pale brown clay loam. The underlying material to a depth of about 60 inches is brown, friable clay loam. In some wooded areas the surface layer is less than 6 inches thick and is black. In some areas along stream benches, the lower part of the subsoil is stratified loamy sand and sandy loam about 20 inches thick.

Air and water move through this soil at a moderately slow rate. Runoff is medium. Available water capabity is high. Organic matter content is moderate. Generally, the surface layer is medium acid or slightly acid and the subsoil medium acid or strongly acid. The supply of available phosphorus and potassium is low. The seasonal high water table is at a depth of 2 to 3 feet.

Most areas are cropland. Some are pasture or woodland. This soil has good potential for cultivated crops, pasture, hay, and woodland. It has fair to poor potential for building site development and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The wetness can delay fieldwork and planting and limit application of the measures needed for weed control. A subsurface drainage system is needed in some areas. The depth to which roots can penetrate is limited as a result of the perched water table and a firm or very firm consistence in the lower part of the subsoil. It is also limited by the acidity of the subsoil, especially if legumes are grown. Applications of lime are needed. A system of minimum tillage in which crop residue is left on the surface helps to control erosion.

This soil is well suited to pasture and hay. Applications of lime generally are needed, especially if a legume, such as alfalfa, is grown. Acid tolerant legumes, such as red clover and alsike clover, survive better than alfalfa, but they tend to provide less forage. A subsurface drainage system generally improves plant growth. Overgrazing results in compaction of the surface layer during wet periods and diminishes the ability of the soil to produce forage.

If this soil is managed as woodland, trees that can tolerate some wetness should be selected for new plantings. The soil is well suited to such trees. Competing vegetation can be controlled by cultivation or by herbicides. Pruning, thinning, and clearing result in better growth in existing stands.

Because it is wet, this soil generally is poorly suited to building site development and sanitary facilities. On sites for buildings with basements, some form of drainage, such as tile around the foundations and under the floor, is needed to remove excess water. Local roads or streets, parking lots, and driveways can be damaged by frost action. Providing adequate subbase material and some form of subsurface drainage that removes trapped water helps to prevent the damage caused by frost action. Septic tank absorption fields should be designed so that they are an adequate distance above the water table.

The capability subclass is IIs.

25—Becker loam. This nearly level, moderately well drained soil is on high bottom land along streams. It is subject to rare flooding. Areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface soil is black and very dark grayish brown. It is loam in the upper 9 inches and sandy loam in the lower 21 inches. The subsoil is dark brown gravelly loamy coarse sand about 6 inches thick. The underlying material to a depth of about 60 inches is grayish brown coarse sand.

Air and water move this soil at a moderately rapid rate. Available water capacity is moderate. Runoff is slow; much of the water is absorbed. The content of organic matter is high. Reaction ranges from medium acid to moderately alkaline. The supply of available phosphorus and potassium is low to medium. The depth to which roots can penetrate is limited by the sandy underlying material. The seasonal high water table is at a depth of 4 to 6 feet.

Most areas are cropland. This soil has fair potential for cultivated crops and pasture. It has fair to poor potential for building site development and sanitary facilities.

This soil tends to be droughty. As a result, suitability for cultivated crops is only fair. The crops selected should be those that can be planted early in the year, when rainfall is most frequent. If crops that mature late in the growing season are grown, the plant population should be limited in most years. A system of minimum tillage in which crop residue is left on the surface helps to control erosion. Increasing the organic matter content improves the water holding capacity of the soil.

Suitability is fair for pasture and hay. Applications of lime generally are needed, especially if a legume, such as alfalfa, is grown. Acid tolerant legumes, such as red clover and alsike clover, survive better than alfalfa, but they tend to provide less forage. A subsurface drainage system generally improves plant growth. Overgrazing results in compaction of the surface layer during wet periods and diminishes the ability of the soil to produce forage.

Suitability is fair for building site development. On sites for buildings with basements, some form of drainage, such as tile around the foundations and under the floor, is needed to remove excess water. Local roads or streets, parking lots, and driveways can be damaged by frost action. Providing adequate subbase material and some form of subsurface drainage that removes trapped water helps to prevent the damage caused by frost action.

This soil generally should not be used as a site for sanitary facilities because it has a seasonal high water table. Septic tank absorption fields should be designed so that they are an adequate distance above the water table.

The capability subclass is IIs.

27A—Dickinson sandy loam, 0 to 1 percent slopes. This level, well drained soil is on broad outwash terraces along the major streams. Areas are about 2 to 40 acres in size.

Typically, the surface soil is very dark grayish brown and dark brown sandy loam about 15 inches thick. The subsoil is about 23 inches thick. It is dark brown and dark yellowish brown sandy loam over yellowish brown sand. The underlying material to a depth of about 60 inches is yellowish brown sand. In many places, especially north of Rochester, bedrock is 5 to 8 feet below the surface. In some areas the content of gravel is as much as 10 percent in the underlying material.

Included with this soil in mapping are small areas of the moderately well drained Terril soils that have a sandy substratum. These soils are in drainageways. They make up as much as 5 percent of some areas.

Permeability is moderately rapid in the Dickinson soil. Available water capacity is low. Runoff is medium to slow; much of the water is absorbed. Natural fertility and the supply of available nitrogen, phosphorus, and potassium are low. Unless the soil is limed, the surface layer and subsoil are medium acid or slightly acid. The content of organic matter is moderate.

Most areas are farmed. Some are used as building sites and others as woodland. This soil has fair potential for cultivated crops, pasture, and hay. It has good potential for building site development and poor potential for most sanitary facilities.

As a result of the low available water capacity, suitability is only fair for small grain, soybeans, and corn. The crops selected for planting should be those that can tolerate droughtiness, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. It is highly susceptible to erosion unless the surface is protected. A system of minimum tillage in which crop residue is left on the surface helps to control erosion.

Suitability is fair for pasture and hay. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Forage production can be improved by reseeding with mixtures of suitable grasses and legumes. Bromegrass or orchardgrass and such legumes as alfalfa, alsike clover, and birdsfoot trefoil grow well. Proper stocking rates, deferred grazing, and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to building site development. It can support buildings and local roads and streets, but the sides of shallow excavations can cave in. This caving can be prevented by enlarging the trenches or by installing temporary retaining walls.

This soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IIs.

27B—Dickinson sandy loam, 2 to 6 percent slopes. This gently sloping, somewhat excessively drained soil is on the convex parts of stream terraces that have low relief, around small natural waterways extending through the terraces or along the foot slopes of valleys. Areas are irregularly shaped or long and narrow. They range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown sandy loam about 10 inches thick. The subsoil is dark brown and dark yellowish brown sandy loam about 25 inches thick. The underlying material to a depth of about 60 inches is yellowish brown sand. In places the surface layer is loamy sand.

Included with this soil in mapping are small areas of the Terril soils that have a sandy substratum. These moderately well drained soils are in small drainageways. They make up about 5 percent of this unit.

Permeability is moderately rapid in the Dickinson soil, and available water capacity is low. The content of organic matter is moderate. Runoff is slow or medium. Reaction is slightly acid or medium acid. The supply of available phosphorus and potassium is low.

Most areas are cropped. This soil has fair potential for cultivated crops, pasture, and hay. It has good potential for building site development and poor potential for most sanitary facilities.

Suitability is fair for small grain, corn, and soybeans. The soil is highly susceptible to erosion unless the surface is protected by plant cover. Contour farming and a

minimum tillage system in which crop residue is left on the surface reduce the risk of erosion. The amount of water available to plants is limited. As a result, the crops selected for planting should be those that can tolerate droughtiness, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This somewhat excessively drained soil is accessible for fieldwork early in spring. Lime and fertilizer should be applied as indicated by soil tests.

Suitability is fair for pasture and hay. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Forage production can be improved by reseeding with mixtures of suitable grasses and legumes. Bromegrass or orchardgrass and such legumes as alfalfa and birdsfoot trefoil grow well. Proper stocking rates, deferred grazing, and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to building site development. It can support buildings and local roads and streets. Erosion control measures are needed during construction. The sides of shallow excavations can cave in. This caving can be prevented by enlarging the trenches or by installing temporary retaining walls.

This soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IIe.

27C—Dickinson sandy loam, 6 to 12 percent slopes. This somewhat excessively drained, sloping soil is on foot slopes in narrow ravines and broad valleys. The surface is plane or concave. Most areas are narrow and are 150 to 300 feet long. They are about 2 to 20 acres in size. Flagstones and rock fragments are on the surface in some areas.

Typically, the surface soil is very dark brown sandy loam about 18 inches thick. The subsoil is about 15 inches thick. It is dark brown sandy loam in the upper 10 inches and loamy sand in the lower 5 inches. The underlying material to a depth of about 60 inches is dark yellowish brown sand. In places the surface layer is 18 to 36 inches thick.

Permeability is moderately rapid, and available water capacity is low. The surface soil is slightly acid or neutral and the subsoil medium acid or slightly acid. Runoff is medium. The content of organic matter is moderate, and the supply of available phosphorus and potassium is low.

Most areas are cultivated. Some are pasture or woodland or are under residential development. This soil has fair potential for pasture, cultivated crops, and hay. It has good to fair potential for building site development and poor potential for most sanitary facilities.

Suitability is fair for small grain, corn, and soybeans. The soil is highly susceptible to erosion unless the surface is protected by plant cover. Contour farming and a minimum tillage system in which crop residue is left on the surface reduce the risk of erosion. The amount of water available to plants is limited. As a result, the crops selected for planting should be those that can tolerate droughtiness, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This somewhat excessively drained soil is accessible for fieldwork early in spring. Lime and fertilizer should be applied as indicated by soil tests.

Suitability is fair for pasture and hay. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Forage production can be improved by reseeding with mixtures of suitable grasses and legumes. Bromegrass or orchardgrass and such legumes as alfalfa and birdsfoot trefoil grow well. Proper stocking rates, deferred grazing, and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to building site development. It can support buildings and local roads and streets. The sides of shallow excavations can cave in, but this caving can be prevented by enlarging the trenches or by installing temporary retaining walls.

This soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be placed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

Capability subclass is IIIe.

30B—Kenyon loam, 1 to 6 percent slopes. This gently sloping, moderately well drained soil is on the summits of glaciated uplands, generally above small, narrow drainageways. In some areas few to many stones are on the surface. They range from as small as cobblestones to as large as boulders. Slopes are about 100 to 400 feet long. Areas range from 2 to 100 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsurface layer is very dark grayish brown clay loam about 5 inches thick. The subsoil is about 37 inches thick. It is yellowish brown, friable clay loam over yellowish brown and brown, firm loam. The underlying material to a depth of about 65 inches is brown, firm loam.

Permeability is moderately slow. Available water capacity is high. Runoff is medium. Unless it has been limed, the surface layer is neutral to medium acid. Most of the subsoil is strongly acid to neutral. The content of organic matter is high, and the supply of available phosphorus and potassium is medium.

Most areas are cultivated. This soil has good potential for cultivated crops, pasture, and hay and for building site development. It has poor potential for septic tank absorption fields but has good potential for other sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of water. In places slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominanted by short, cool season grasses, such as Kentucky bluegrass. Reseeding the pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer and controlled grazing keep the more productive grasses dominant.

This soil is well suited to building site development and to most sanitary facilities. Better suited material is needed, however, to strengthen the base material of local roads and streets. Septic tank absorption fields should be designed so that they are large enough to overcome the moderately slow permeability in the underlying material.

The capability subclass is IIe.

42E—Salida gravelly sandy loam, 12 to 35 percent slopes. This excessively drained, moderately steep to very steep soil is on the sides of kames and the lower back slopes of stream benches. Areas are very narrow and long and range from 2 to 30 acres in size. Slopes are convex and about 50 to 100 feet long. Many cobblestones, flagstones, and pebbles are on the surface.

Typically, the surface layer is very dark grayish brown gravelly sandy loam about 6 inches thick. The subsurface layer is very dark grayish brown gravelly loamy coarse sand about 6 inches thick. The subsoil is dark yellowish brown gravelly coarse sand about 6 inches thick. The underlying material to a depth of about 60 inches is yellowish brown gravel and gravelly coarse sand. In some areas the surface layer is gravelly loamy coarse sand. In some places cemented gravel crops out. In other places the surface layer and subsoil are sandy loam or loam.

Available water capacity is very low, and permeability is very rapid. The soil is neutral or mildly alkaline in the upper part and mildly alkaline in the lower part. It has a low or very low supply of available phosphorus and potassium. The content of organic matter is moderate.

Most areas are pastured. This soil has fair potential for pasture and hay and poor potential for cultivated crops. It has poor potential for building site development and sanitary facilities.

Suitability is only fair for pasture because forage production is limited on this droughty soil. Most pastures are dominated by Kentucky bluegrass, which becomes dormant during the warm summer months. Continuous production of summer forage can be ensured by measures that foster the growth of short native prairie grasses, such as little bluestem and side-oats grama. These measures include early grazing of cool season grasses and deferment of grazing during the growth period of warm season grasses. Overgrazing increases the runoff rate and thus the risk of erosion.

This soil is poorly suited to building site development because the moderately steep to very steep slope is a severe limitation. Extensive land shaping is needed on all building sites. The sides of shallow excavations can cave in, but this caving can be prevented by enlarging the trenches or by installing temporary retaining walls.

This soil is poorly suited to sanitary facilities because it is moderately steep to very steep. On sites for sanitary facilities, lateral seepage is a hazard and the effluent can pollute ground water.

The capability subclass is VIIs.

73F—Bellechester loamy sand, 25 to 45 percent slopes. This very steep, excessively drained soil is on foot slopes on deeply dissected terrain. Slopes are smooth and concave. They are 100 to 400 feet long. In most areas they are south to west facing. Areas are 5 to 20 acres in size. Few to common coarse fragments, mostly rock fragments or flagstones, are on the surface in places.

Typically, the surface soil is very dark grayish brown loamy sand about 20 inches thick. The subsoil is dark brown and very pale brown loamy sand and sand about 14 inches thick. Below this is about 9 inches of yellow sand. White, soft sandstone is at a depth of about 43 inches. On some wooded slopes facing north to east, the soil has a thinner surface layer and is slightly acid or medium acid throughout.

Included with this soil in mapping are Brodale and Sogn soils on the upper parts of the landscape where ledges of limestone bedrock protrude. These soils are in areas about a half an acre in size. They make up about 5 percent of some areas. Also included are areas where the slope is as low as 6 percent.

Permeability is rapid in Bellechester soil, and available water capacity is low. Reaction ranges from slightly acid to moderately alkaline throughout the profile. The content of organic matter is low. The supply of available phosphorus and potassium also is low. Runoff is medium.

Most areas are pastured. This soil has fair potential for pasture. It has poor potential for cultivated crops, sanitary facilities, and building site development.

Suitability is only fair for pasture because forage production is limited on this droughty soil. Most pastures are dominated by Kentucky bluegrass, which is dormant during the warm summer months. Continuous production of summer forage can be ensured by measures that foster the growth of short native prairie grasses, such as little bluestem and side-oats grama. These measures include early grazing of cool season grasses and deferment of grazing during the growth period of warm season grasses. Overgrazing increases the runoff rate and the risk of erosion.

Suitability is only fair for woodland because erosion is a hazard on this very steep soil. Measures that control erosion are needed. Tree seedlings survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, or by spraying, cutting, or girdling.

This soil is poorly suited to building site development and sanitary facilities because it is very steep. Extensive land shaping is needed on all building sites. The effluent from sanitary facilities can pollute the ground water in the bedrock.

The capability subclass is VIIs.

99B—Racine silt loam, 1 to 6 percent slopes. This moderately well drained and well drained, gently sloping soil is on the summits of glaciated uplands. Slopes are 100 to 400 feet long. Areas range from 2 to 100 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 34 inches thick. It is dark yellowish brown, friable clay loam over yellowish brown, friable sandy clay loam. The underlying material to a depth of about 65 inches is brown loam. It is friable in the upper part and very firm in the lower part. In places the surface layer and subsoil are thicker.

Permeability is moderate, and available water capacity is high. Runoff is medium. The surface layer is slightly acid or medium acid. The subsoil dominantly is strongly acid or medium acid. The content of organic matter is moderate. The supply of available phosphorus and potassium is medium.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, hay, and woodland. It also has good potential for sanitary facilities and building site development.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of water. In places slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominanted by short, cool season grasses, such as Kentucky bluegrass. Reseeding the pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Rotation grazing, proper stocking rates, and applications of fertilizer keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees.

This soil is well suited to building site development and sanitary facilities. Better suited material is needed, however, to strengthen the base material of local roads and streets.

The capability subclass is IIe.

99C—Racine silt loam, 6 to 12 percent slopes. This sloping, well drained soil is on the convex side slopes directly below upland summits. Areas are narrow and are 50 to 300 feet long. They range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is dark yellowish brown clay loam about 51 inches thick. The underlying material to a depth of about 65 inches is olive brown, firm loam. In some wooded areas, the surface soil is loam about 18 inches thick. In places the surface layer and subsoil are thinner. Cobblestones are commonly on the surface in areas where the subsoil has been exposed.

Water and air move through this soil at a moderate rate. Available water capacity is high. Reaction is strongly acid or medium acid in most of the subsoil and varies widely in the surface layer as a result of local liming practices. Natural fertility and the supply of available phosphorus and potassium are medium. The content of organic matter is moderate.

Most areas are farmed. This soil has good potential for cultivated crops, hay, pasture, and woodland. It has fair potential for most sanitary facilities and for building site development.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface reduces the risk of erosion and improves the intake of water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Prunning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

Suitability is only fair for building site development and sanitary facilities. Roads or streets can be damaged as a result of low strength. Providing suitable subbase material helps to prevent this damage. Lateral seepage is a

hazard unless septic tank absorption fields are designed to overcome the slope of this soil.

The capability subclass is IIIe.

99D2—Racine loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is on side slopes along long, narrow drainageways. The surface is convex, and slopes are 50 to 200 feet long. Areas are typically 2 to 10 acres in size. In some areas very large boulders or a few cobblestones are on the surface.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is brown and yellowish brown, friable loam about 26 inches thick. It has blocky structure. The underlying material to a depth of about 65 inches is yellowish brown, firm and very firm loam that is high in content of lime.

Permeability is moderate, and available water capacity is high. Runoff is rapid. The content of organic matter is low. The supply of available phosphorus is medium and that of potassium low. Reaction is medium acid or strongly acid in most parts of the subsoil and varies widely in the surface layer as a result of local liming practices.

This soil is used as cropland or pasture. It has good potential for pasture and woodland and fair potential for cultivated crops. It has poor potential for building site development and most sanitary facilities.

Suitability is only fair for corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or if the surface is not protected by crop residue. Leaving crop residue on the surface reduces the risk of erosion and improves the intake of water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Prunning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities because it is moderately steep. Local roads or streets can be damaged as a result of low strength. Providing suitable subbase material helps to prevent this damage. Lateral seepage is a hazard unless septic tank absorbtion fields are designed to overcome the slope of this soil.

Capability subclass is IVe.

131B—Massbach silt loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil generally is on the summits and side slopes of upland hills in dissected stream valleys. In some areas it is on foot slopes. The surface is convex. Areas are irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 23 inches of brown silty clay loam and clay. It is mottled with grayish brown in the upper part. The underlying material is greenish gray shale. It has thin fragments of limestone. In places the surface layer is very dark brown and is as much as 14 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Shullsburg soils in drainageways and depressions. These soils make up about 5 percent of some areas.

Permeability is moderate in the upper part of the Massbach soil and very slow in the lower part. Runoff is medium. Available water capacity is high. The depth to which roots can penetrate is limited by the underlying shale. The seasonal high water table is perched at a depth of 3 to 5 feet. The surface soil and subsoil are neutral to medium acid. The content of organic matter is moderate. The supply of available phosphorus is low to medium, and the supply of available potassium is low.

This soil is used as cropland, pasture, or woodland. It has good potential for those uses. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of water. In places slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees.

Suitability is fair for building site development. Installing tile drains around basements helps to remove excess subsurface water. Constructing local roads and streets on better suited base material and above the seasonal

high water table helps to prevent the damage resulting from low strength and frost action.

This soil is poorly suited to sanitary facilities. Septic tank absorption fields generally do not function properly because the soil is very slowly permeable and has a high water table.

The capability subclass is IIe.

131C—Massbach silt loam, 6 to 12 percent slopes. This sloping, well drained soil is on the upper side slopes and foot slopes along valley floors. Areas are mostly narrow and extend horizontally around hills. They are 100 to 400 feet long. They range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 38 inches thick. The upper 30 inches is dark brown, grayish brown, and yellowish brown silt loam, and the lower 8 inches is greenish gray clay. The underlying material is greenish gray shale. In places the surface layer is very dark brown and is as thick as 16 inches. In some areas the depth to shale is 24 to 30 inches. In other areas, along the lower foot slopes, the depth to shale is as much as 55 inches. In some of these areas the shale is overlain by thin strata of sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Shullsburg soils in drainageways and depressions. These soils are less sloping than the Massbach soil. They make up about 5 percent of this unit.

Permeability is moderate in the upper part of the Massbach soil and very slow in the underlying material. Available water capacity is high. Runoff is medium. The content of organic matter is moderate. Reaction is neutral to medium acid. The supply of available potassium generally is low and that of phosphorus medium. Root penetration is restricted by the underlying shale.

Most areas are cropland or pasture. This soil has good potential for cultivated crops, pasture, hay, and woodland. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface reduces the risk of erosion and improves the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

Suitability is only fair for building site development. Measures that control erosion are needed during construction. Building local roads and streets on better suited base material helps to prevent the damage resulting from low strength and frost action.

This soil is poorly suited to sanitary facilities. Proper design of septic tank absorption fields helps to overcome the very slow permeability of the underlying material.

The capability subclass is IIIe.

131D—Massbach silt loam, 12 to 18 percent slopes. This well drained, moderately steep soil is on the upper side slopes on dissected uplands. Areas are narrow and extend horizontally around hills. They are 100 to 400 feet long. They range from about 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper 27 inches of the subsoil is dark brown and brown silt loam, and the lower 6 inches is olive brown and greenish gray clay. The underlying material is greenish gray shale. In places the surface layer is silty clay loam. In some areas the silty mantle is severely eroded and very thin. On some foot slopes the depth to clayey material or to shale is more than 40 inches.

Permeability is moderate in the upper part of this soil and very slow in the underlying material. Available water capacity is high. Runoff is rapid. Reaction is slightly acid or medium acid throughout the soil. The content of organic matter is moderate. The supply of available phosphorus typically is low or medium, and that of available potassium typically is low. The effective rooting depth is restricted by the underlying shale.

Most areas are cropland. This soil has fair potential for cultivated crops and good potential for pasture, hay, and woodland. It has poor potential for building site development and for most sanitary facilities.

Suitablity is only fair for corn, soybeans, and small grain because erosion is a severe hazard. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface reduces the risk of erosion and improves the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Many pastures, however, are dominated by short, cool season grasses because of overgrazing. Reseeding the pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applica-

tions of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities. The moderately steep slope is a severe limitation. Measures that control erosion are needed during construction. Building local roads and streets on better suited base material helps to prevent the damage resulting from low strength and frost action. Proper design of septic tank absorption fields helps to overcome the very slow permeability of the underlying material.

The capability subclass is IVe.

143B—Eleva sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in plane or convex areas on low lying knolls in the uplands or on benches along streams. Areas are irregularly shaped and are 2 to 25 acres in size.

Typically, the surface layer is very dark brown sandy loam about 4 inches thick. The subsurface layer is dark brown sandy loam about 5 inches thick. The upper 12 inches of the subsoil is dark yellowish brown fine sandy loam. The lower 11 inches is brownish yellow fine sand. The underlying material is soft sandstone bedrock. In places the surface soil is loam.

Included with this soil in mapping are areas where the sandstone bedrock crops out. These areas are less than 2 acres in size. They make up less than 5 percent of the unit.

Water and air move through this soil at a moderately rapid rate. Available water capacity is low, and runoff is medium. Reaction is neutral or slightly acid in the surface layer and slightly acid to strongly acid in the subsoil. The content of organic matter is low. Natural fertility and the supply of available phosphorus and potassium also are low. Root penetration is restricted by the underlying sandstone.

Most areas are farmed. This soil has fair potential for cultivated crops and good potential for pasture, hay, and woodland. It has fair potential for building site development and poor potential for most sanitary facilities.

Suitability is only fair for cultivated crops because the amount of water available to plants is limited in this soil. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Mulch tillage, contour farming, or other measures that help to control erosion are needed. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Maintaining pastures is somewhat difficult, however, because the soil is droughty. Many pastures are dominated by Kentucky bluegrass, which generally is dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass or orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and deferred and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedling mortality is slight, but plant competition is severe. Applying herbicides and cultivating help to control weeds and other competing vegetation. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability is only fair for building site development. The underlying bedrock can support foundations and buildings, but heavy machinery is needed for excavations.

This soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is only moderately deep to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIIs.

143C—Eleva sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is on the sides of small circular knolls in the uplands. Areas are 50 to 250 feet long. They are 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsoil is dark yellowish brown sandy loam about 15 inches thick. The underlying material is light yellowish brown and white sand. Soft weathered sandstone bedrock is at a depth of about 40 inches. In places the slope is more than 12 percent. In some areas the surface layer is loamy sand less than 8 inches thick.

Included with this soil in mapping are areas of Plainfield soils and areas where sandstone crops out. These inclusions make up about 10 percent of some areas. They are near the top of knolls or on nose slopes.

Permeability is moderately rapid in the Eleva soil, and available water capacity is low. Runoff is medium. The surface layer typically is slightly acid or neutral and the subsoil slightly acid to strongly acid. The supply of available phosphorus and potassium is low. The content of organic matter also is low. Root penetration is limited by the weathered sandstone.

Most areas are farmed. This soil has fair potential for cultivated crops and good potential for pasture, hay, and woodland. It has fair potential for building site development and poor potential for sanitary facilities.

Suitability is only fair for cultivated crops because the amount of water available to plants is limited. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in

summer. If corn or soybeans are grown, the plant population should be limited. Mulch tillage, contour farming, or other measures that control erosion are needed. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Maintaining pastures is somewhat difficult, however, because the soil is droughty. Many pastures are dominated by Kentucky bluegrass, which generally is dormant during the hot, dry summer months. Reseeding pastures with mixtures of suitable grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and deferred and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedling mortality is slight, but plant competition is severe. Applying herbicides and cultivating help to control weeds and other competing vegetation. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability is only fair for building site development. The underlying bedrock can support foundations and buildings, but heavy machinery is needed for excavations.

This soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is only moderately deep to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIIe.

173F—Frontenac loam, 15 to 35 percent slopes. This moderately steep to very steep, well drained soil is on the foot slopes in valleys. The surface is plane or concave. Areas range from 75 to 300 feet in length and from 5 to 20 acres in size.

Typically, the surface layer is black loam about 10 inches thick. The subsurface layer is very dark grayish brown loam about 4 inches thick. The subsoil is dark brown loam about 13 inches thick. The underlying material to a depth of about 60 inches is yellowish brown channery loam. In places shale or limestone bedrock is at a depth of 3 to 5 feet. In some areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Brodale and Haverhill soils. Brodale soils are steeper than the Frontenac soil. They are on south- and west-facing slopes. Haverhill soils are in seep spots associated with shale bedrock. Included soils make up about 10 percent of most areas.

Permeability and available water capacity are moderate in the Frontenac soil. Runoff is rapid. Reaction is slightly acid or neutral in the upper part of the soil and neutral or mildly alkaline in the lower part. Organic matter content is high. The supply of available phosphorus and potassium is medium.

Most areas are pasture or woodland. This soil has poor potential for cultivated crops because it is moderately steep to very steep. It has fair potential for pasture and woodland and poor potential for building site development and sanitary facilities.

Suitability is fair for permanent woodland. A good woodland understory reduces the runoff rate and helps to control erosion. In some areas timber can be harvested. Natural revegetation can occur in these areas if the trees to be harvested are carefully selected. In most areas the trees cannot be planted by machines because the soil is too steep. Pruning and thinning help to maintain a good stand.

Suitability is fair for pasture. Clearing or overgrazing wooded tracts in pastured areas destroys the woodland understory. Destroying the understory increases the runoff rate and results in excessive soil losses. Proper stocking rates and deferred and rotation grazing help to maintain a plant cover that adequately protects the soil from erosion.

Some areas are suitable as sites for paths and trails. Establishing the paths and trails on the contour helps to control erosion and keeps gullies from forming.

This soil is poorly suited to building site development and sanitary facilities. Excavating is difficult because the underlying material has a high content of coarse fragments. Also, soil slippage is a hazard in the steep and very steep areas. Constructing local roads on the contour helps to divert runoff. The soil is too steep for sanitary facilities. Also, the effluent from these facilities can pollute ground water.

The capability subclass is VIIe.

176—Garwin silty clay loam. This nearly level, poorly drained soil is at the head of drainageways and in drainageways on uplands. Areas are widest near the head of the drainageways and narrowest in the lower part of the drainageways. They range from 2 to 20 acres in size.

Typically, the surface soil is black silty clay loam about 13 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown and grayish brown silty clay loam over olive gray silt loam. The underlying material to a depth of about 65 inches is olive gray silt loam. In some of the drainageways, the surface soil is as thick as 30 inches.

Permeability is moderate, and available water capacity is high. Runoff is slow. Natural fertility and the supply of available phosphorus and potassium are medium. The content of organic matter is high. The surface layer and subsoil are neutral or slightly acid. The seasonal high water table is at a depth of 1 foot to 2 feet.

Most areas are farmed. If drained, this soil has good potential for cultivated crops. It has good potential for pasture, hay, and wetland wildlife habitat and poor potential for building site development and sanitary facilities.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Providing artificial drainage and keeping the soil in good tilth are the main management needs. The soil warms earlier in the spring if it is plowed in the fall. Also, fields are accessible for earlier

seedbed preparation. Waterways are needed in places to divert runoff.

This soil is well suited to pasture. Introducing mixtures of legumes and grasses improves most pastures. Water tolerant grasses, such as Garrison creeping foxtail, or legumes, such as alsike clover and birdsfoot trefoil, grow well in undrained areas. Controlled grazing is needed when the surface layer is wet. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

This soil is poorly suited to building site development and sanitary facilities because it is wet. Tile drains are needed around foundations of basements. The high water table results in a high potential for frost action. Local roads and streets and parking lots should be constructed above the water table. The high water table also interferes with the proper functioning of septic tank absorption fields.

The capability subclass is IIw.

203—Joy silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is in plane or slightly concave areas above upland drainageways. Typically, areas are widest on the upper part of drainageways and narrowest on the lower part, where they are surrounded by steeper side slopes. They range from 2 to 25 acres in size.

Typically, the surface soil is black silt loam about 20 inches thick. The subsoil is dark grayish brown and olive brown silt loam about 30 inches thick. The underlying material to a depth of about 65 inches is grayish brown silt loam.

Included with this soil in mapping are small areas of the poorly drained Garwin soils in drainageways. Also included are soils that have a slope of more than 4 percent and do not have a seasonal high water table. Included soils make up as much as 15 percent of most areas.

Permeability is moderate in the Joy soil, and available water capacity is high. The root zone is restricted by the seasonal high water table, which is at a depth of 2 to 4 feet. Runoff is medium. The content of organic matter is high. Reaction is slightly acid or neutral in the surface layer and slightly acid to mildly alkaline below. The supply of available phosphorus and potassium is medium.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and hay. It has poor potential for sanitary facilities and building site development.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. A subsurface drainage system improves the effective rooting depth. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Reseeding with mixtures of grasses and legumes renovates pastures in poor condition. Bromegrass and orchardgrass and such legumes as alfalfa, birdsfoot trefoil, and alsike clover grow well. Proper stocking rates and rotation and deferred grazing keep the more productive forage plants dominant.

This soil is poorly suited to building site development and sanitary facilities. Tile drains around basements help to remove excess subsurface water. Building local roads and streets on better suited base material and above the seasonal high water table helps to prevent the damage caused by frost action. Septic tank absorption fields do not function properly because of the seasonal high water table. Also, the effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IIe.

209A—Kegonsa silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces that are several feet above flood plains. The surface is plane or slightly convex. Most areas are irregularly shaped and range from 2 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 17 inches thick. It is dark brown and yellowish brown silt loam in the upper part and dark brown sandy clay loam in the lower part. The lower part contains numerous fine pebbles. The underlying material to a depth of about 60 inches is yellowish brown and brown sand and very coarse sand.

Permeability is moderate in the upper part of this soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is slow. Unless limed, the soil is slightly acid or medium acid in the surface layer and slightly acid to strongly acid in subsoil. The content of organic matter is moderate. The supply of available phosphorus and potassium is low to medium.

This soil is used as cropland, pasture, hayland, and woodland. It has good potential for those uses and for building site development. The potential for most sanitary facilities is poor.

Though this soil is well suited to small grain, soybeans, and corn, the amount of water available to plants is limited. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. It can be eroded easily, however, unless the surface is protected. A minimum tillage system in which crop residue is left on the surface reduces the risk of erosion.

This soil is well suited to pasture. Overgrazed pastures, however, are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass or orchardgrass and such legumes as alfalfa, alsike clover,

and birdsfoot trefoil grow well. Proper stocking rates and deferred and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedlings survive and grow well. Control of plant competition is needed. Weeds can be controlled by cultivating or by applying herbicides. Pruning and thinning help to establish and maintain a good stand of trees.

This soil is well suited to building site development. The sides of shallow excavations, however, are unstable. Enlarging the trenches or installing temporary retaining walls keeps the sides from caving in.

Though this soil can easily absorb septic tank effluent, the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IIs.

209B—Kegonsa silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on upland summits and kames and in remnant outwash areas that have been cut by small drainageways. The surface is convex. Areas range from 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is dark brown silt loam and loam about 17 inches thick. The underlying material to a depth of about 60 inches is yellowish brown loamy coarse sand and sand. In places either yellowish brown loam till or limestone bedrock is at a depth of about 6 feet.

Permeability is moderate in the upper part of this soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The content of organic matter is moderate. The supply of available phosphorus is medium and that of available potassium low. Reaction is medium acid to neutral in the surface layer and medium acid to strongly acid in the upper part of the subsoil.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, hay, and woodland. It has good potential for building site development and poor potential for most sanitary facilities.

Though this soil is well suited to small grain, corn, and soybeans, it can be eroded easily unless the surface is protected. Contour farming and a minimum tillage system in which crop residue is left on the surface reduce the risk of erosion. The amount of water available to plants is limited. As a result, the crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Overgrazed pastures, however, are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa and birdsfoot trefoil grow well. Proper stocking rates and deferred and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedlings survive and grow well. Control of plant competition is needed. Weeds can be controlled by cultivating or by applying herbicides. Pruning and thinning help to establish and maintain a good stand of trees. Planting on the contour and other measures that help to control erosion are needed in areas where trees are planted.

This soil is well suited to building site development. The sides of shallow excavations, however, are unstable. Enlarging the trenches or installing temporary retaining walls keeps the sides from caving in.

Though this soil can easily absorb septic tank effluent, the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IIe.

216B—Lamont sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil dominantly is on slightly convex slopes on bedrock-controlled uplands. In some areas it is on stream benches. Areas are long and narrow and are oriented northwest to southeast. They range from 2 to 30 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsoil is yellowish brown. It is 12 inches of sandy loam and loam over 7 inches of loamy sand. The next layer, to a depth of about 60 inches, is yellowish brown fine sand. Below this is yellowish brown sand.

Included with this soil in mapping are some areas of Plainfield soils on the crest of rises. These excessively drained soils make up about 10 percent of some areas.

Permeability is moderately rapid in the upper part of the Lamont soil and very rapid in the lower part. Available water capacity is low. Runoff is medium. The supply of available nitrogen, phosphorus, and potassium is low. Unless limed, the surface layer ranges from medium acid to neutral. The lower part of the subsoil ranges from neutral to strongly acid. The content of organic matter is low.

Most areas are farmed. Some are wooded or pastured. This soil has fair potential for cultivated crops and woodland. It has good potential for pasture and building site development and poor potential for most sanitary facilities.

Suitability is only fair for small grain, corn, and soybeans. This soil is highly susceptible to erosion unless the surface is protected. Contour farming and a minimum tillage system in which crop residue is left on the surface reduce the risk of erosion. The amount of water available

to plants is limited. As a result, the crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Overgrazed pastures, however, are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa and birdsfoot trefoil grow well. Proper stocking rates and deferred and rotation grazing keep the more productive forage plants dominant.

Suitability is only fair for woodland. Seedlings can survive and grow well, but control of plant competition is needed. Weeds can be controlled by cultivating or by applying herbicides. Pruning and thinning help to establish and maintain a good stand of trees. Planting on the contour and other measures that help to control erosion are needed in areas where trees are planted.

This soil is well suited to building site development. It has enough strength to support buildings and local roads and streets. The sides of shallow excavations, however, are unstable. Enlarging the trenches or installing temporary retaining walls keeps the sides from caving in.

Though this soil can easily absorb septic tank effluent, the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IIIe.

244C—Lilah sandy loam, 6 to 12 percent slopes. This excessively drained, rolling soil is on irregularly shaped hills in the uplands. Slopes are convex and extend from hilltops to the base of side slopes or to escarpments. They are 50 to 100 feet long. Areas are 2 to 20 acres in size. Numerous cobblestones, flagstones, and pebbles are on the surface.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The content of gravel in this layer is about 10 percent. The subsoil is about 47 inches thick. It is dark yellowish brown sandy loam and dark brown loamy coarse sand in the upper part and strong brown gravelly loamy coarse sand in the lower part. The underlying material to a depth of about 70 inches is yellowish brown coarse sand. In some areas calcium carbonates are as shallow as 10 inches.

Available water capacity is very low, and permeability is very rapid. Runoff is slow. The surface layer and subsoil have a low content of organic matter. They are strongly acid to neutral. The depth to which roots can penetrate is restricted by the very coarse underlying material, which does not store enough water to stimulate the growth of roots. The supply of the major plant nutrients, such as phosphorus and potassium, is low.

Almost all areas are cropped or pastured. This soil has fair to poor potential for pasture and hay, cultivated crops, and woodland. It has good potential for building site development and poor potential for most sanitary facilities.

This soil is poorly suited to cultivated crops because it can hold only a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn and soybeans are grown, the plant population should be limited. The soil is subject to severe erosion unless it is protected by such measures as mulch tillage or contour farming. Also, the surface layer is subject to soil blowing, and seedlings can be damaged by blowing sand. Leaving crop residue on the surface and mixing part of the residue with the surface layer help to control soil blowing.

Suitability for pasture and hay is only fair because this soil is droughty. Keeping pasture in good condition is difficult. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass or orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and deferred and rotation grazing keep the more productive forage plants dominant.

Suitability for woodland is fair. Seedling mortality and plant competition are severe. Weed control and pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in bare areas where trees are newly planted.

This soil is well suited to building site development. It can support buildings and local roads and streets. The sides of shallow excavations, however, are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls.

This soil can easily absorb septic tank effluent. The underlying material, however, is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IVs.

251F—Marlean silty clay loam, 25 to 40 percent slopes. This very steep, well drained soil is on the sides of ravines leading into river valleys. The ravines are 50 to 150 feet deep. Slopes are 100 to 250 feet long. Most are north to east facing. Areas range from 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 10 inches thick. The subsoil is dark brown flaggy silty clay about 8 inches thick. The underlying material to a depth of about 72 inches is dark brown flaggy clay loam.

Included with this soil in mapping are areas of Dorerton soils, which make up about 10 percent of this unit. These soils generally are on shoulders. Also included are alluvial soils that are high in content of coarse fragments. These soils are in drainageways.

Permeability is moderately rapid in the Marlean soil, and avalable water capacity is low. Runoff is rapid or very rapid. The surface layer and subsoil range from medium acid to mildly alkaline, and the underlying material is mildly alkaline. The content of organic matter is moderate. The supply of available phosphorus and potassium is low.

Most areas are wooded. Some are pastured. This soil has fair potential for woodland and woodland wildlife habitat. It has poor potential for cultivated crops, pasture, building site development, and sanitary facilities.

Suitability for permanent woodland is fair. A good woodland understory reduces the runoff rate and helps to control erosion. In some areas timber can be harvested. These areas can revegetate naturally if the trees to be harvested are carefully selected. In most areas trees cannot be planted by machine because the soil is very steep. Pruning and thinning help to maintain a good stand of timber.

Clearing trees from pastured areas or overgrazing the areas destroys the woodland understory. Destruction of the understory increases the runoff rate and results in excessive erosion. Proper stocking rates, deferred grazing, and rotation grazing maintain an adequate plant cover and thus prevent excessive soil losses.

Some areas are suitable as sites for paths and trails. Establishing the paths and trails on the contour helps to control erosion and keeps gullies from forming.

This soil is poorly suited to building site development because the very steep slope is a severe limitation. Local roads should be constructed on the contour as much as possible to help divert runoff. The soil is poorly suited to sanitary facilities because it is very steep.

The capability subclass is VIIe.

251G—Marlean silty clay loam, 40 to 80 percent slopes. This very steep, well drained soil is on side slopes in stream valleys. Local relief ranges from about 150 feet to 350 feet. Slopes are 200 to 400 feet long and are north to east facing. Areas range from 5 to 50 acres in size. Few to common scattered stones are on the surface. They are as small as fragments and as large as flagstones.

Typically, the surface layer is very dark grayish brown silty clay loam about 10 inches thick. The subsoil is dark brown flaggy silty clay loam about 8 inches thick. The underlying material to a depth of about 60 inches is dark brown flaggy clay loam.

Included with this soil in mapping are areas of Dorerton soils on shoulders. These soils are shallower than the Marlean soil and contain more clay in the subsoil. Also included are very steep escarpments where ledges of bedrock protrude.

Permeability is moderately rapid in the Marlean soil, and available water capacity is low. Runoff is very rapid. The surface layer is slightly acid or neutral, and the subsoil and underlying material are mildly alkaline. The content of organic matter is moderate. The supply of available phosphorus and potassium is low.

Most areas are wooded. This soil has fair potential for woodland and woodland wildlife habitat. It has poor potential for pasture, building site development, and sanitary facilities.

Suitability for permanent woodland is fair. A good woodland understory reduces the runoff rate and helps to control erosion. In some areas trees can be harvested for timber. These areas can revegetate naturally if the trees to be harvested are carefully selected. In most areas trees cannot be planted by machine because the soil is very steep. Pruning and thinning help to maintain a good stand of timber.

Some areas are pastured. Clearing the trees from these areas or overgrazing the areas destroys the woodland understory. Destruction of the understory increases the runoff rate and results in excessive erosion. Proper stocking rates and rotation and deferred grazing maintain an adequate plant cover and thus prevent excessive soil losses.

Some areas are suitable as sites for paths and trails. Establishing the paths and trails on the contour helps to control erosion and keeps gullies from forming.

This soil is very poorly suited to building site development and sanitary facilities because it is very steep.

The capability subclass is VIIe.

252—Marshan silt loam. This nearly level, very poorly drained soil generally is on stream terraces directly upslope from low lying flood plains and meandering streams. In some areas it is in broad drainageways on glaciated uplands. It is subject to rare flooding. Areas are as much as 50 acres in size and generally are oriented in the same direction as the stream. The smaller areas are in the broad drainageways.

Typically, the surface soil is black and very dark grayish brown silt loam about 18 inches thick. The subsoil is dark gray and olive gray silt loam and loam about 12 inches thick. The underlying material to a depth of about 60 inches is grayish brown and yellowish brown sand and gravelly sand.

Included with this soil in mapping are areas of soils in which calcium carbonates are at the surface. These soils are better drained than the Marshan soil. They typically are on mounds about a half an acre in size. They make up about 12 percent of some mapped areas.

Permeability is moderate in the upper part of the Marshan soil and rapid in the underlying material. Available water capacity is moderate. Runoff is slow. The soil is slightly acid or neutral throughout. The effective rooting depth generally is 30 inches. The content of organic matter is high. The supply of available phosphorus and potassium is medium. The seasonal high water table is at a depth of 1 foot to 2.5 feet.

Most areas are cropped or pastured. If drained, this soil has good potential for cultivated crops, pasture, and hay. It has good potential for wetland wildlife habitat and poor potential for building site development and sanitary facilities.

If drained, this soil is well suited to corn and soybeans. Wetness can delay fieldwork early in the year, interfere with weed control, and delay harvesting. The effective rooting depth is limited by the high water table. If tilled in the fall, the soil warms up earlier in the spring and is accessible for earlier seedbed preparation.

This soil is well suited to pasture. Introducing mixtures of legumes and grasses can improve most pastures. Water tolerant grasses, such as Garrison creeping foxtail, or legumes, such as alsike clover or birdsfoot trefoil, grow well in undrained areas. Controlled grazing is needed when the surface layer is wet. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

This soil is poorly suited to building site development and sanitary facilities because it is wet and is subject to flooding. As a result of the high water table, local roads and streets are subject to frost action and septic tank absorption fields cannot function properly. Properly designing the roads and streets helps to prevent the damage caused by frost action.

The capability subclass is IIw.

283B—Plainfield loamy sand, 0 to 6 percent slopes. This nearly level and gently sloping, excessively drained soil is on broad terraces along streams. The surface is convex, and slopes are 50 to 150 feet long. Areas range from 5 to 200 acres in size.

Typically, the surface layer is very dark brown loamy sand about 4 inches thick. The subsurface layer is dark grayish brown loamy sand about 6 inches thick. The subsoil is dark brown sand about 11 inches thick. The underlying material to a depth of 65 inches is brown sand.

Included with this soil in mapping are areas where the water table is at a depth of about 45 inches. Also included are areas where limestone bedrock is at a depth of about 60 inches. Included soils make up about 10 percent of some mapped areas.

Permeability is rapid in the Plainfield soil, runoff is slow, and available water capacity is low. Natural fertility and organic matter content are low. Reaction is medium acid or strongly acid in the surface layer and subsoil.

Almost all areas are cropped, pastured, or wooded. This soil has fair to poor potential for cultivated crops, pasture, and woodland because of the low available water capacity. It has good potential for building site development and poor potential for most sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn and soybeans are grown, the plant population should be limited. The soil is accessible for fieldwork early in spring because it warms up quickly and is excessively drained. It is highly susceptible to erosion unless it is protected by such measures as mulch tillage and contour farming. Also, the surface layer is subject to soil blowing, and seedlings can be damaged by blowing sand. Leaving crop residue on the surface and mixing part of the residue with the surface layer help to control soil blowing.

Suitability for pasture is only fair because this soil is droughty. Keeping pastures in good condition is difficult. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for woodland is fair. Seedling mortality and plant competition are severe. Weed control and pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in bare areas where trees are newly planted.

This soil is well suited to building site development. It can support buildings and local roads and streets. The sides of shallow excavations, however, are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. Erosion and soil blowing are severe hazards during and following construction.

This soil can easily absorb septic tank effluent. The underlying material, however, is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is IVs.

283C—Plainfield sand, 6 to 12 percent slopes. This sloping, excessively drained soil is on the narrow escarpments of stream terraces that adjoin lower flood plains or stream terraces. The surface is convex, and slopes are 50 to 150 feet long. Areas range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown sand about 6 inches thick. The subsurface layer is dark grayish brown sand about 7 inches thick. The subsoil is yellowish brown sand about 20 inches thick. The underlying material to a depth of 60 inches is yellowish brown sand.

Permeability is rapid, and available water capacity is low. Runoff is slow. Reaction is medium acid or strongly acid in the surface layer and subsoil. Natural fertility and the content of organic matter are low.

Most areas are wooded. Some are left idle or are pastured. This soil has fair potential for woodland. It has poor potential for pasture, hay, and cultivated crops be-

cause it is droughty. It has good potential for building site development and poor potential for most sanitary facilities.

This soil is poorly suited to pasture because it is droughty. Keeping pastures in good condition is difficult. Overgrazed areas are dominated by the less productive grasses, such as Kentucky bluegrass. Erosion is a severe hazard in these areas. Controlled grazing or deferred grazing increases the extent of the more productive native grasses, such as side-oats grama and little bluestem.

This soil is fairly well suited to woodland. Seedling mortality and plant competition are severe. Applying herbicides and cultivating help to control competing vegetation. Pruning and thinning help to establish and maintain a good stand of trees. Measures that control erosion, such as planting on the contour, are needed if trees are planted.

This soil is well suited to building site development. It can support buildings and local roads and streets. The sides of shallow excavations, however, are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. Erosion and soil blowing are severe hazards during and following construction.

The upper part of this soil can easily absorb septic tank effluent. The underlying material, however, is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is VIs.

283E—Plainfield sand, 12 to 30 percent slopes. This moderately steep to very steep, excessively drained soil is on the escarpments of stream terraces and on the lower foot slopes in deep, narrow ravines on bedrock-controlled uplands (fig. 6). Areas are narrow and range from 2 to 30 acres in size.

Figure 6.—An area of Plainfield soils. These soils are highly susceptible to erosion unless adequately protected by plant cover.

Typically, the surface layer is dark brown sand about 8 inches thick. The subsoil is dark yellowish brown sand about 28 inches. The underlying material to a depth of 60 inches is yellowish brown, loose sand. In places, especially on the upper foot slopes, bedrock or residuum of bedrock is as shallow as 60 inches.

Permeability is rapid, and available water capacity is low. Runoff is slow to medium; much of the water is absorbed because the infiltration rate is high. Natural fertility and the content of organic matter are low.

Most areas are wooded. Some are pastured. This soil has fair potential for woodland and poor potential for woodland wildlife habitat and pasture. It has fair potential for building site development and poor potential for most sanitary facilities.

Suitability for permanent woodland is fair. A good woodland understory reduces the runoff rate and helps to control erosion. In some areas trees can be harvested for timber. These areas can revegetate naturally if the trees to be harvested are carefully selected. In most areas trees cannot be planted by machine because the soil is moderately steep to very steep. Pruning and thinning help to maintain a good stand of timber.

This soil is poorly suited to pasture. Clearing the trees from pastured areas or overgrazing the areas destroys the woodland understory. Destruction of the understory increases the runoff rate and results in excessive erosion. Controlled grazing helps to maintain an adequate plant cover and thus helps to prevent excessive soil loss.

This soil is very poorly suited to building site development and sanitary facilities because of a severe hazard of erosion.

The capability subclass is VIIs.

285A—Port Byron silt loam, 0 to 1 percent slopes. This nearly level, well drained soil is on broad, loess-covered uplands, typically in slightly convex areas between drainageways. Areas are long and narrow and range from 2 to 30 acres in size.

Typically, the surface soil is very dark brown silt loam about 15 inches thick. The subsoil is dark yellowish brown, friable silt loam about 31 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam.

Permeability is moderate, and available water capacity is high. Runoff is medium. The surface layer is medium acid or slightly acid, and the subsoil is neutral to medium acid. The content of organic matter is high. The supply of available phosphorus and potassium is medium or high.

Most areas are cropped. This soil has good potential for cultivated crops, hay, pasture, building site development, and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and legumes, such as alfalfa, birdsfoot trefoil, and alsike clover, grow well. Proper stocking rates and rotation or deferred grazing keep the more productive forage plants dominant.

This soil is well suited to building site development and most sanitary facilities. It has severe limitations, however, as a site for local roads and streets.

The capability class is I.

285B—Port Byron silt loam, 1 to 5 percent slopes. This gently sloping, well drained soil is on ridges and side slopes adjacent to small drainageways. The surface is convex, and slopes are 100 to 400 feet long. Areas generally are long and narrow. They range from 2 to 100 acres in size.

Typically, the surface soil is very dark brown silt loam about 12 inches thick. The subsurface layer is very dark grayish brown silt loam about 3 inches thick. The subsoil is dark brown, dark yellowish brown, and yellowish brown silt loam about 31 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. In places loam glacial till is within a depth of 50 inches.

Permeability is moderate, and available water capacity is very high. Runoff is medium. The upper 40 inches is medium acid to neutral. The content of organic matter is high, and the supply of available phosphorus and potassium is medium.

Most areas are cropped. This soil has very good potential for cultivated crops, pasture, hay, building site development, and most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In some areas slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer and controlled grazing keep the more productive grasses dominant.

This soil is well suited to building site development and sanitary facilities. Hard-surfaced local roads or streets, parking lots, and driveways, however, are likely to be damaged as a result of low strength and frost action, especially in periods following a rainy fall. Providing better suited subbase material helps to prevent this damage.

The capability subclass is IIe.

285C—Port Byron silt loam, 5 to 9 percent slopes. This sloping, well drained soil is on the sides of small tributary valleys. The surface is convex, and slopes are 100 to 300 feet long. Areas range from 8 to 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 10 inches thick. The subsoil is dark brown silt loam about 25 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. In places loamy glacial till is as shallow as 50 inches.

Permeability is moderate, and available water capacity is high. Runoff is medium. Unless the soil has been limed, the surface layer is medium acid or slightly acid and the subsoil is medium acid. The content of organic matter is moderate to high. The supply of available potassium typically is medium, and the supply of available phosphorus is medium or high.

Most areas are cropped. Some small areas are permanent pasture. This soil has good potential for cultivated crops, hay, pasture, building site development, and most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by a cover of crop residue. Leaving crop residue on the surface reduces the risk of erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, rotation grazing, and deferred grazing keep the more productive grasses dominant.

This soil is well suited to building site development and most sanitary facilities. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage resulting from frost action and low strength. Lateral seepage from septic tank absorption fields is a hazard unless the fields are designed to overcome the slope.

The capability subclass is IIIe.

289—Radford silt loam. This nearly level, somewhat poorly drained soil is on low bottom land along streams. A few small stream channels carry water across the landscape. The soil is occasionally flooded. Areas are 300 to 1,600 feet wide and are 10 to 100 acres in size.

Typically, the surface soil is very dark gray silt loam about 12 inches thick. The underlying material is very dark gray silt loam about 17 inches thick. Below this is a buried soil that is black silt loam in the upper part and dark gray silt loam in the lower part.

Permeability is moderate, and available water capacity is very high. The content of organic matter is high in the alluvium and very high in the upper part of the buried soil. The soil is neutral or mildly alkaline throughout. The supply of available phosphorus and potassium is low or medium. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas are cropped. Some are used for pasture or hay. This soil has good potential for cultivated crops, pasture, and hay. It has poor potential for building site development and sanitary facilities.

If drained, this soil is well suited to corn and soybeans. Wetness can delay fieldwork early in the year, can interfere with weed control, and can delay harvesting. The effective rooting depth is limited by the high water table. If tilled in the fall, the soil warms up earlier in the spring and is accessible for earlier seedbed preparation. Grassed waterways are needed in some areas to carry away surface water.

This soil is well suited to pasture. Most pastures can be improved by introducing mixtures of legumes and grasses. Water tolerant grasses, such as Garrison creeping foxtail, or legumes, such as alsike clover and birdsfoot trefoil, grow well in undrained areas. Controlled grazing is needed when the surface layer is wet. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

This soil is poorly suited to building site development and sanitary facilities because it is wet and is subject to flooding. As a result of the high water table, local roads and streets are subject to frost action and septic tank absorption fields cannot function properly. Properly designing the roads and streets helps to prevent the damage caused by frost action.

The capability subclass is IIw.

295—Readlyn loam. This nearly level, somewhat poorly drained soil is on slightly convex summits on broad glacial uplands. Areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface soil is black and very dark grayish brown loam about 16 inches thick. The subsoil is about 28 inches thick. The upper 6 inches is dark grayish brown loam mottled with dark brown, and the lower 22 inches is yellowish brown, firm loam mottled with dark grayish brown and grayish brown. The underlying material to a depth of 65 inches is brown, very firm loam that has distinct gray and strong brown mottles.

Permeability is moderately slow, and available water capacity is high. Runoff is medium. The seasonal high water table is at a depth of 2 to 4 feet. Unless the soil has been limed, the surface layer is slightly acid or medium acid and the subsoil slightly acid to strongly acid. The content of organic matter is high. The supply of available phosphorus and potassium is medium.

Most areas are cropped. This soil has good potential for cultivated crops, hay, and pasture. It has poor potential for building site development and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. A subsurface drainage system can improve cropland. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and legumes, such as alfalfa, birdsfoot trefoil, and alsike clover, grow well. Controlled grazing, proper stocking rates, and rotation grazing keep the more productive forage plants dominant.

This soil is poorly suited to building site development and sanitary facilities. Tile drains around basements help to remove excess subsurface water. Building local roads and streets on better suited base material and above the seasonal high water table helps to prevent the damage resulting from low strength and frost action. Properly designing septic tank absorption fields helps to overcome the moderately slow permeability and the high water table.

The capability class is I.

298—Richwood silt loam, 0 to 2 percent slopes. This well drained, nearly level soil is on the low lying terraces along streams and narrow drainageways. Most of the terraces are about 1 to 6 feet above the banks of streams or the bottoms of drainageways. The soil is subject to rare flooding. Areas are long and narrow and range from 2 to 70 acres in size.

Typically, the surface soil is black and very dark brown silt loam about 16 inches thick. The subsurface layer is dark brown silt loam about 8 inches thick. The subsoil is about 35 inches thick. The upper 26 inches is dark brown and yellowish brown silt loam and loam, and the lower 9 inches is dark brown sandy loam. The underlying material to a depth of 70 inches is brown sand. In places the depth to sand is as much as 7 feet.

Permeability is moderate, and available water capacity is high. Runoff is slow. The surface layer and subsoil are medium acid to neutral. The content of organic matter is high. The supply of available phosphorus and potassium is medium.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, and hay. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and legumes, such as alfalfa, birdsfoot trefoil, and alsike clover, grow well. Proper stocking rates and rotation and deferred grazing keep the more productive forage plants dominant.

Suitability for building site developments is only fair. Flooding is a hazard, but it can be easily overcome by designing the building so that the water is removed from the site. The soil can support buildings and local roads and streets. The sides of shallow excavations, however, are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls.

This soil can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute underground water supplies.

The capability class is I.

299A—Rockton loam, 0 to 1 percent slopes. This nearly level, well drained soil is on bedrock-controlled uplands, on the head slopes of drainageways on the summits of hills. Very shallow depressions 50 to 200 feet in diameter are in some areas. Water ponds for brief periods in these depressions. Areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is very dark brown loam about 9 inches thick. The subsurface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 21 inches thick. The upper 15 inches is dark brown loam, and the lower 6 inches is dark brown clay loam or clay. The underlying material is hard limestone. In places the surface layer is silt loam or sandy loam. In some areas the underlying material is soft sandstone.

Water and air move through this soil at a moderate rate. Runoff is medium. Available water capacity is moderate. The surface layer is medium acid or slightly acid, and the subsoil is strongly acid to slightly acid. The supply of available phosphorus and potassium is low to medium. The content of organic matter is high. The depth to which roots can penetrate is restricted by the bedrock.

Most areas are farmed. This soil has good potential for cultivated crops, hay, and pasture. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The amount of water that is available to plants is limited. As a result, the plant population should be limited if corn or soybeans are grown. Also, early maturing crops are better suited. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Keeping pastures in good condition is difficult, however, because the soil is droughty. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation

grazing keep the more productive forage plants dominant.

Suitability for building site development is only fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to most sanitary facilities. Installing septic tank absorption fields is difficult because of the moderate depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIs.

299B—Rockton loam, 1 to 6 percent slopes. This gently sloping, well drained soil occupies summits on bedrock-controlled uplands. Areas are irregular in shape and range from 2 to 100 acres in size. Rock fragments and flagstones are common on the surface.

Typically, the surface soil is very dark brown and very dark grayish brown loam about 15 inches thick. The subsoil is about 16 inches thick. It is dark brown and dark yellowish brown loam, sandy clay loam, and clay. The underlying material is hard limestone.

Included with this soil in mapping are areas of Channahon soils in similar positions on the landscape. These soils are shallower to bedrock than the Rockton soil. They make up 5 to 10 percent of the mapped areas.

Water and air move through the Rockton soil at a moderate rate. Runoff is medium, and available water capacity is moderate. The surface layer is medium acid or slightly acid, and the subsoil is strongly acid to slightly acid. The supply of available phosphorus and potassium is low or medium. The content of organic matter is high. The depth to which roots can penetrate is restricted by the limestone bedrock.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and hay. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to cultivated crops. The amount of water available to plants, however, is limited. As a result, the crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard in cultivated areas. Mulch tillage, contour farming, or other measures that control erosion are needed. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Keeping pastures in good condition is difficult, however, because the soil is droughty. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for building site development is only fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to most sanitary facilities. Installing septic tank absorption fields is difficult because of the moderate depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIe.

299C—Rockton loam, 6 to 12 percent slopes. This sloping, well drained soil is on side slopes and foot slopes in the uplands. The surface is convex, and slopes are 200 to 300 feet long. Areas are 2 to 20 acres in size. Rock fragments and flagstones are common on the surface.

Typically, the surface soil is black and very dark brown loam about 18 inches thick. The subsoil is dark brown clay loam about 13 inches thick. The underlying material is hard limestone. In some eroded areas the surface layer is dark brown loam or clay loam.

Included with this soil in mapping are areas of Channahon soils in similar positions on the landscape. These soils are shallower to bedrock than the Rockton soil. They make up about 15 percent of this unit.

Water and air move through the Rockton soil at a moderate rate. Runoff is rapid, and available water capacity is moderate. The soil is medium acid or slightly acid throughout. The supply of available phosphorus and potassium is low to medium. The content of organic matter is high. The depth to which roots can penetrate is restricted by the limestone bedrock.

Most areas are cropped. This soil has fair potential for cultivated crops and good potential for pasture and hay. It has fair potential for building site development and poor potential for most sanitary facilities.

Suitability for cultivated crops is only fair because the amount of water available to plants is limited. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard in cultivated areas. Mulch tillage, contour farming, or other measures that control erosion are needed. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Keeping pastures in good condition is difficult, however, because the soil is droughty. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for building site development is only fair. This soil can support foundations and buildings, but

heavy machinery is needed for excavations in the underlying bedrock. Measures that control erosion are needed in the steeper areas. Installing septic tank absorption fields is difficult because of the moderate depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIIe.

301B—Lindstrom silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on head slopes in the uplands and on foot slopes near the base of valley walls. The surface is concave. Slopes are 100 to 400 feet long. Areas range from 2 to 30 acres in size.

Typically, the surface soil is black and very dark grayish brown silt loam about 31 inches thick. The subsoil is dark brown and yellowish brown silt loam about 13 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. In some areas in drainageways, the upper 20 inches contains lighter colored stratified sediments. In places the slope is 0 to 2 percent. In some areas the surface layer is less than 31 inches thick.

Available water capacity is very high, and permeability is moderate. Runoff is medium. The content of organic matter is high. The surface layer is medium acid to neutral, and the subsoil is slightly acid or medium acid. The supply of available phosphorus and potassium is medium.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, hay, building site development, and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Some slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to building site development and sanitary facilities. Frost action is likely to damage hard-surfaced local roads or streets, parking lots, and driveways, especially in periods following a rainy fall. Providing better suited subbase material reduces the extent of this damage.

The capability subclass is IIe.

301C—Lindstrom silt loam, 6 to 15 percent slopes. This sloping and moderately steep, well drained soil is on foot slopes below valley walls. Areas are long and narrow and typically extend along the base of hills. Slopes are plane to concave and are 100 to 400 feet long. A few rocks have rolled in from adjoining hillsides. They are as small as fragments and as large as boulders.

Typically, the surface soil is very dark gray and very dark grayish brown silt loam about 24 inches thick. The subsoil is dark brown silt loam and silty clay loam about 31 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. In places, especially near the upper part of slopes, part of the underlying material is clayey residuum or broken material derived from limestone, or both. In some areas the surface layer is loam. In other areas, especially near the back slope part of valley walls, the slope is as much as 20 percent.

Available water capacity is very high, and permeability is moderate. Runoff is medium or rapid. The content or organic matter is high. The surface layer is slightly acid or neutral, and the subsoil is slightly acid or medium acid. The supply of available phosphorus and potassium is medium.

Almost all areas are cropped or pastured. This soil has good potential for cultivated crops, pasture, and hay. It has good to fair potential for building site development and fair potential for most sanitary facilities.

Suitability for corn, soybeans, and small grain is fair. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to building site development. The suitability for most sanitary facilities, however, is only fair. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage caused by frost action. Lateral seepage from sanitary facilities is a hazard unless the facilities are designed to overcome the slope.

The capability subclass is IVe.

309C—Schapville silty clay loam, 6 to 12 percent slopes. This sloping, moderately well drained soil is on convex side slopes in the uplands. Areas are irregularly shaped and range from 2 to 20 acres in size. Slopes are 50 to 300 feet long. A few scattered rock fragments are on the surface.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsoil is about 12 inches thick. It is dark brown silty clay loam in the upper part and yellowish brown clay in the lower part. The underlying material to a depth of 60 inches is extremely firm, light yellowish brown shale. It has many bluish gray mottles. In some areas the surface layer is dark grayish brown silty clay. In other areas it is silt loam.

Water and air move through this soil at a very slow rate. Runoff is medium, and available water capacity is moderate. The surface layer and subsoil are mildly alkaline to medium acid. The content of organic matter is moderate. The supply of available phosphorus is low to medium, and the supply of available potassium is high. The depth to which roots can penetrate is restricted by the underlying shale.

Most areas are farmed. This soil has fair potential for cultivated crops and good potential for pasture and hay. It has fair to poor potential for building site development and most sanitary facilities.

Suitability for corn, soybeans, and small grain is fair. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

Suitability for building site development is only fair because this soil has low strength and a moderate shrink-swell potential and is sloping. Building local roads and streets on better suited base material helps to prevent road damage. The soil is poorly suited to septic tank absorption fields because it is very slowly permeable and sloping.

The capability subclass is IIIe.

309D—Schapville silty clay loam, 12 to 25 percent slopes. This moderately steep and steep, moderately well drained soil is on plane or convex side slopes in the uplands. Areas are long and narrow and extend horizontally around hills. They range from 2 to 15 acres in size. Slopes are 50 to 250 feet long.

Typically, the surface soil is black silty clay loam about 15 inches thick. The subsoil is olive brown clay about 5 inches thick. The underlying material is greenish gray shale. In places the surface soil is very dark grayish brown silty clay.

Water and air move through this soil at a very slow rate. Runoff is rapid, and available water capacity is moderate. The surface layer and subsoil are medium acid to mildly alkaline. The supply of available phosphorus is low or medium, and the supply of available potassium is high. The content of organic matter is moderate. The depth to which roots can penetrate is restricted by the underlying shale.

Almost all areas are farmed or pastured. This soil has poor potential for cultivated crops and fair potential for pasture and hay. It has poor potential for building site development and sanitary facilities.

This soil is poorly suited to cultivated crops. The hazard of erosion is severe if the plant cover is removed.

Suitability for pasture is fair. As a result of overgrazing, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is poorly suited to building site development because it is moderately steep and steep and has low strength and a moderate shrink-swell potential. Building local roads and streets on better suited base material helps to prevent road damage. The soil is poorly suited to most sanitary facilities because it is very slowly permeable and moderately steep or steep.

The capability subclass is VIe.

312B—Shullsburg silt loam, 2 to 6 percent slopes. This gently sloping, somewhat poorly drained soil is in concave areas on foot slopes in the uplands. Slopes are 100 to 300 feet long. Areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface soil is black and very dark grayish brown silt loam about 17 inches thick. The subsoil is about 20 inches thick. It is dark grayish brown and dark brown silty clay loam in the upper part and yellowish brown clay in the lower part. The underlying material is greenish gray shale.

Included with this soil in mapping are areas of Haverhill soils. These soils are very poorly drained and are fine textured. They make up less than 5 percent of this unit.

Water and air move through the Shullsburg soil at a slow rate. Runoff is medium, and available water capacity is high. The surface layer and subsoil are slightly acid or neutral. The supply of available phosphorus and potassium is medium. The content of organic matter is high. The depth to which roots can penetrate is restricted by the underlying shale. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas are cropped. This soil has good potential for cultivated crops, hay, and pasture. It has poor potential for building site development and sanitary facilities.

If drained, this soil is well suited to corn, soybeans, and small grain. The main concerns of management are wetness and the hazard of erosion. A subsurface drain-

age system is needed to reduce the wetness. Returning crop residue to the soil helps to control erosion and improves tilth. If tilled in the fall, the soil warms up earlier in the spring and is accessible for earlier fieldwork. In places grassed waterways are needed to carry away surface water.

This soil is well suited to pasture. Most pastures can be improved by introducing mixtures of legumes and grasses. Water tolerant grasses, such as Garrison creeping foxtail, and legumes, such as alsike clover and birdsfoot trefoil, grow well in undrained areas. Controlled grazing is needed when the surface layer is wet. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

This soil is poorly suited to building site development. Tile drains are needed around the basement of buildings to help lower the seasonal high water table. Providing better suited base material for local roads and streets and for parking lots helps to prevent the damage resulting from the low strength of this soil. As a result of the slow permeability and the wetness, this soil is poorly suited to septic tank absorption fields and other sanitary facilities.

The capability subclass is IIw.

312C—Shullsburg silt loam, 6 to 12 percent slopes. This sloping, somewhat poorly drained soil is in concave areas on foot slopes in the uplands. Areas are irregularly shaped and range from 2 to 20 acres in size. Slopes are 50 to 250 feet long.

Typically, the surface soil is black and very dark gray silt loam about 15 inches thick. The subsoil is about 12 inches thick. The upper part is dark grayish brown silty clay loam, and the lower part is dark grayish brown silty clay. The substratum is greenish gray shale. In places 4- to 10-inch layers of limestone bedrock are within 4 feet of the surface.

Water and air move through this soil at a slow rate. Runoff is medium, and available water capacity is high. The surface soil and subsoil are neutral or slightly acid. The content of organic matter is high. The supply of available phosphorus and potassium is medium. The depth to which roots can penetrate is restricted by the underlying shale. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas are farmed. This soil has fair potential for cultivated crops and good potential for pasture and hay. It has poor potential for building site development and sanitary facilities.

Suitability for corn, soybeans, and small grain is fair. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer and deferred grazing keep the more productive grasses dominant.

This soil is poorly suited to building site development and sanitary facilities. Tile drains are needed around basements to help remove excess subsurface water. Building local roads and streets on better suited base material and above the seasonal high water table helps to prevent the damage resulting from the low strength of this soil. Septic tank absorption fields can function properly only if their design overcomes the slow permeability and the high water table.

The capability subclass is IIIe.

313—Spillville silt loam. This nearly level, moderately well drained soil is on flood plains along the major streams. A few small, shallow depressions are on the flood plains. The soil is occasionally flooded. Areas range from 5 to 50 acres in size.

Typically, the surface soil is black and very dark brown silt loam and loam about 39 inches thick. The subsoil is dark grayish brown and grayish brown loam about 21 inches thick. The underlying material to a depth of 70 inches is grayish brown coarse sand. In places the surface layer is less than 39 inches thick. In some areas it is sandy loam.

Permeability is moderate, and available water capacity is high. Runoff is slow. The surface layer and the upper part of the subsoil are slightly acid or neutral. The content of organic matter is high. The supply of available phosphorus and potassium is medium or high. The seasonal high water table is at a depth of 3 to 5 feet.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and hay. It has poor potential for building site development and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. A subsurface drainage system can improve cropland. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and legumes, such as alfalfa, birdsfoot trefoil, and alsike clover, grow well. Proper stocking rates and rotation or deferred grazing keep the more productive forage plants dominant.

This soil is poorly suited to building site development and sanitary facilities because it is wet and subject to flooding. The high water table can interfere with excavating for foundations and basements. Tile drains are needed around the foundations of basements to drain excess subsurface water. As a result of the high water

table, the potential for frost action is moderate and septic tank absorption fields cannot function properly. Building local roads and streets and parking lots above the water table helps to prevent frost action. The effluent from sanitary facilities can pollute underground water supplies.

The capability class is I.

322C—Timula silt loam, 6 to 12 percent slopes. This sloping, well drained soil is in convex areas on the summits and knolls on loess-covered uplands. Slopes are 50 to 200 feet long. Areas are 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is yellowish brown, very friable silt loam about 13 inches thick. The underlying material to a depth of 70 inches is calcareous, yellowish brown silt loam. On the eroded, concave parts of side slopes, the limy underlying material is exposed. In places the surface layer is thicker and darker colored. In some areas the subsoil is more clayey.

Water and air move through this soil at a moderate rate. Runoff is medium. Available water capacity is high. The soil is slightly acid to mildly alkaline throughout. The supply of available phosphorus and potassium is low or medium. The content of organic matter is low.

Most areas are cultivated. This soil has good potential for cultivated crops, pasture, hay, woodland, building site development, and most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of competing plants is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

Although the slope is a moderate limitation, this soil is well suited to building site development and sanitary facilities. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage caused by frost action. Lateral seepage from septic tank absorption fields is a hazard unless the design of these fields overcomes the slope.

The capability subclass is IIIe.

322D—Timula silt loam, 12 to 18 percent slopes. This moderately steep, well drained soil is on the convex sides of knolls in the uplands. Slopes are 50 to 250 feet long. Areas are generally long and narrow and range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is yellowish brown silt loam about 13 inches thick. The underlying material to a depth of 60 inches is calcareous, yellowish brown silt loam. In places it is exposed. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the well drained Lindstrom soils. These soils are in drainageways and on foot slopes. They make up about 5 percent of most mapped areas.

Permeability is moderate. Runoff is rapid. Available water capacity is high. The soil is slightly acid to mildly alkaline throughout. The supply of available phosphorus and potassium is low or medium. The content of organic matter is low.

Most areas are cropped. This soil has fair potential for cultivated crops and good potential for woodland, hay, and pasture. It has fair to poor potential for building site development and poor potential for sanitary facilities.

Suitability for corn, soybeans, and small grain is fair. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of competing plants is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

Because the slope is a severe limitation, this soil is poorly suited to building site development. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Constructing local roads and streets on better suited base material helps to prevent the damage caused by frost action. The soil is poorly suited to sani-

tary facilities. Lateral seepage from septic tank absorption fields is a hazard unless the design of these fields overcomes the slope.

The capability subclass is IVe.

322E—Timula silt loam, 18 to 30 percent slopes. This steep and very steep, well drained soil is on the convex sides of knolls between drainageways in the uplands. Slopes are 50 to 200 feet long. Areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown silt loam about 22 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silt loam. In places the limy underlying material is exposed. In some areas the slope is more than 30 percent.

Permeability is moderate. Runoff is rapid. Available water capacity is high. The soil is slightly acid to mildly alkaline throughout. The supply of available phosphorus and potassium is low to medium. The content of organic matter is low.

Most areas are pastured or wooded. This soil has fair potential for pasture and woodland and poor potential for cultivated crops, building site development, and sanitary facilities.

This soil is poorly suited to cultivated crops. It is best suited to pasture and woodland. Erosion is a severe hazard in cultivated areas.

Most pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Seeding suitable legumes or a mixture of legumes and grasses improves the pasture. Applications of fertilizer help to establish and maintain the grasses. Proper stocking rates and deferred grazing maintain a good plant cover and help to control erosion.

This soil is suitable as woodland. Weed control and pruning and thinning help to remove competing plants. Erosion is a hazard if the plant cover is removed. Measures that control erosion are needed in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities. Erosion is a hazard on building sites. Local streets and roads that are built on the contour divert runoff. Building them on the contour helps to control erosion. Lateral seepage is the main concern if sanitary facilities are installed on this soil.

The capability subclass is VIIe.

333—Vasa silt loam. This nearly level, moderately well drained soil is on the head slopes of drainageways in the uplands. The surface is plane or slightly concave. Areas are long and narrow and range from 2 to 30 acres in size.

Typically, the surface soil is very dark grayish brown and dark brown silt loam about 14 inches thick. The subsoil is silt loam about 31 inches thick. It is dark yellowish brown and brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is grayish brown silt loam. In places it is glacial till.

Permeability is moderate, and available water capacity is very high. Runoff is slow or medium. The seasonal high water table is at a depth of 2 to 4 feet. The surface layer is neutral to medium acid, and the lower part of the subsoil is strongly acid or medium acid. The content of organic matter is moderate. The supply of available phosphorus and potassium is medium.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and woodland. It has fair to poor potential for building site development and poor potential for sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and legumes, such as alfalfa, birdsfoot trefoil, and alsike clover, grow well. Proper stocking rates and rotation and deferred grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedlings can survive and grow well, but control of competing plants is needed. Applications of herbicide and cultivation control weeds. Pruning and thinning help to establish and maintain a good stand of trees.

Suitability for building site development is fair. The high water table can interfere with excavating for foundations and basements. Tile drains are needed around the foundations of basements to drain excess subsurface water. As a result of the high water table, the potential for frost action is high and septic tank absorption fields cannot function properly. Building local roads and streets and parking lots above the water table and on better suited base material helps to prevent the damage resulting from frost action and low strength. The effluent from sanitary facilities can pollute underground water supplies.

The capability class is I.

340B—Whalan loam, 1 to 6 percent slopes. This gently sloping, well drained soil is on plane or slightly convex summits in the uplands. Areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is very dark gray loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The subsoil is about 19 inches thick. The upper 9 inches is dark brown loam, and the lower 10 inches is dark yellowish brown clay loam or clay that contains pebbles. Limestone bedrock is at a depth of 27 inches. It typically is hard, but in places it is very soft.

Included with this soil in mapping are scattered areas of Channahon and Waucoma soils. These areas are less

than 2 acres in size and make up less than 10 percent of the unit. Channahon soils are shallower and Waucoma soils deeper to bedrock than the Whalan soil.

Water and air move through the Whalan soil at a moderate rate. Runoff is medium. Available water capacity is moderate. The content of organic matter is low. The supply of available potassium and phosphorus is medium. The surface layer is slightly acid or neutral, and the upper part of the subsoil is medium acid or strongly acid. The depth to which roots can penetrate is restricted by the underlying bedrock.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and woodland. It has fair potential for building site development and poor potential for sanitary facilities.

This soil is well suited to cultivated crops. The amount of water available to plants, however, is limited. As a result, the crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. The soil is susceptible to erosion unless it is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Keeping pastures in good condition is difficult, however, because the soil is droughty. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is moderately deep over bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIe.

340C—Whalan loam, 6 to 12 percent slopes. This sloping, well drained soil is on the convex parts of hills and knolls. Slopes are 200 to 300 feet long. Areas are somewhat irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is dark grayish brown and grayish brown loam about 10 inches thick. The subsoil is about 19 inches thick. It is dark brown loam in the upper part and dark yellowish brown clay loam in the lower part. The underlying material is soft bedrock. In places the bedrock is very hard.

Included with this soil in mapping are areas of Channahon soils in similar positions on the landscape. These soils make up about 8 percent of this unit. They are less than 20 inches deep over bedrock.

Water and air move through the Whalan soil at a moderate rate. Runoff is medium, and available water capacity is moderate. The content of organic matter is low. The supply of available phosphorus and potassium typically is low or medium. The surface layer is slightly acid or neutral, and the upper part of the subsoil is medium acid or strongly acid. The depth to which roots can penetrate is restricted by the underlying bedrock.

Most areas are cropped. This soil has fair potential for cultivated crops and good potential for pasture and woodland. It has fair potential for building site development and poor potential for sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. The soil is susceptible to erosion unless it is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Keeping pastures in good condition is difficult, however, because the soil is droughty. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. Measures that control erosion are needed on building sites. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is moderately deep over bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIIe.

369B—Waubeek silt loam, 1 to 6 percent slopes. This moderately well drained, gently sloping soil is on the

convex summits of broad uplands. Areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 32 inches thick. It is yellowish brown and brown silt loam in the upper part and olive brown loam in the lower part. The underlying material to a depth of 70 inches is olive brown, calcareous loam. In places it is silt loam.

Available water capacity is high, and permeability is moderate. Runoff is medium. The content of organic matter is moderate. The surface layer is medium acid to neutral, and the upper part of the subsoil is strongly acid or medium acid. The supply of available phosphorus and potassium is medium.

Most areas are farmed. This soil has good potential for cultivated crops, hay, pasture, woodland, building site development, and most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In places slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

Though this soil is well suited to pasture, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass, because of overgrazing. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees.

This soil is well suited to building site development and sanitary facilities. Better suited material is needed to strengthen the base material of local roads and streets and to prevent the damage caused by frost action.

The capability subclass is IIe.

369C—Waubeek silt loam, 6 to 12 percent slopes. This well drained, sloping soil is on convex side slopes on broad uplands. Slopes are 100 to 400 feet long. Areas are narrow and are parallel to drainageways. They range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 35 inches thick. The upper 20 inches is dark yellowish brown silt loam, and the lower 15 inches is dark yellowish brown loam. The underlying material to a depth of 70 inches is calcareous, brown loam till. In some areas the surface layer is very dark brown and is as much as 12 inches thick. In places the surface layer and the upper part of subsoil are loam.

Included with this soil in mapping are Racine soils in small areas where the silt mantle thins out and Lilah soils in areas where small pockets of gravel occur. These areas are a half acre to an acre in size and make up less than 5 percent of this unit.

Available water capacity is high in the Waubeek soil, and permeability is moderate. Runoff is medium or rapid. The surface layer is slightly acid or neutral, and the upper part of the subsoil is strongly acid or medium acid. The content of organic matter is moderate. The supply of available phosphorus and potassium is medium.

Most areas are farmed. This soil has good potential for cultivated crops, hay, pasture, woodland, building site development, and most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improve forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

Though it has low strength and is susceptible to frost action, this soil is well suited to building site development. Building local roads and streets on better suited base material helps to prevent road damage. The soil is well suited to sanitary facilities.

The capability subclass is IIIe.

378—Maxfield silty clay loam. This nearly level, poorly drained soil is in drainageways and on head slopes in areas of glacial drift on uplands. Areas are long and narrow and range from 2 to 50 acres in size.

Typically, the surface soil is black and very dark gray silty clay loam about 15 inches thick. The subsoil is about 25 inches thick. The upper 17 inches is grayish brown silty clay loam or silt loam that has distinct light olive brown mottles, and the lower 8 inches is yellowish brown loam. The underlying material to a depth of 60 inches is yellowish brown loam mottled with light gray. In places the subsoil contains less clay.

Water and air move through this soil at a moderate rate. Available water capacity is high. Runoff is slow. The surface layer is slightly acid or neutral, and the subsoil is medium acid to neutral. The supply of available phosphorus and potassium is medium. The content of organic matter is high. The seasonal high water table is at a depth of 1 to 2 feet. It limits the depth to which roots can penetrate.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, and hay. It has poor potential for building site development and sanitary facilities.

This soil is well suited to corn and soybeans. Wetness can delay fieldwork early in the year, can interfere with weed control, and can delay harvesting. The effective rooting depth is limited by the high water table. If tilled in the fall, the soil warms up earlier in the spring and is accessible for earlier seedbed preparation. In some areas grassed waterways are needed to carry away surface water.

This soil is well suited to pasture. Most pastures can be improved by introducing mixtures of legumes and grasses. Water tolerant grasses, such as Garrison creeping foxtail, and legumes, such as alsike clover and birdsfoot trefoil, grow well in undrained areas. Controlled grazing is needed when the surface layer is wet. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

This soil is poorly suited to building site development and sanitary facilities because it is wet. As a result of the high water table, the potential for frost action is high and septic tank absorption fields cannot function properly. Properly designing local roads and streets helps to prevent the damage caused by frost action.

The capability subclass is IIw.

401B—Mt. Carroll silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on summits in the uplands. The surface generally is convex. Areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark brown silt loam about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown silt loam and silty clay loam about 39 inches thick. The underlying material to a depth of 72 inches is yellowish brown silt loam. In places loam glacial till is at a depth of 4 to 6 feet.

Permeability is moderate, and available water capacity is very high. Runoff is medium in most areas but is slow or medium in wooded areas. The surface layer is slightly acid or neutral, and the subsoil is medium acid. The content of organic matter is moderate. Typically, the supply of available potassium is low or medium and the supply of available phosphorus is high or medium.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, woodland, building site development, and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In places slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees.

This soil is well suited to building site development and sanitary facilities. Hard-surfaced local roads or streets, parking lots, and driveways are likely to be damaged as a result of low strength and frost action, especially in periods following a rainy fall. Providing better suited subbase material reduces the extent of this damage.

The capability subclass is IIe.

401C—Mt. Carroll silt loam, 6 to 12 percent slopes. This sloping, well drained soil is on side slopes on dissected uplands. The surface generally is convex. Slopes are 75 to 350 feet long. Areas range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown silt loam about 23 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. In places loam glacial till is at a depth of 4 to 6 feet.

Permeability is moderate. Runoff is rapid in bare areas and medium in areas that have a plant cover. Available water capacity is very high. Unless the soil has been limed, the surface layer is neutral or slightly acid and the subsoil is medium acid. The content of organic matter is moderate. Generally, the supply of available potassium is low and the supply of available phosphorus is medium or high.

Almost all areas are cropped, wooded, or pastured. This soil has good potential for cultivated crops, pasture, woodland, and building site development. It has fair potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by

short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Erosion is a hazard in areas where trees are newly planted. Cultivating or spraying helps to control weeds in these areas. Pruning and thinning help to establish and maintain a good stand of trees.

Suitability for sanitary facilities is fair. Lateral seepage is a hazard unless the design of septic tank absorption fields overcomes the slope. The soil is well suited to building site development. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage resulting from low strength and frost action.

The capability subclass is IIIe.

401C2—Mt. Carroll silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on side slopes on dissected uplands. The surface generally is convex. In most areas the slope is 8 percent or more. Slopes are 75 to 350 feet long. Areas range from 2 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown silty clay loam about 20 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. In places loam glacial till is at a depth of 4 to 6 feet. In very severely eroded areas, the surface layer is dark brown silty clay loam.

Permeability is moderate. Runoff is rapid in most areas but is medium in wooded areas. Available water capacity is high. The surface layer is neutral or slightly acid, and the subsoil is medium acid. The content of organic matter is low. Generally, the supply of available potassium is low or medium and the supply of available phosphorus is medium or high.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, woodland, and building site development. It has fair potential for sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Erosion is a hazard in areas where trees are newly planted. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying controls competing plants. Pruning and thinning help to establish and maintain a good stand of trees.

Suitability for sanitary facilities is fair. Lateral seepage is a hazard unless the design of septic tank absorption fields overcomes the slope. The soil is well suited to building site development. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage resulting from frost action and low strength.

The capability subclass is IIIe.

401D—Mt. Carroll silt loam, 12 to 18 percent slopes. This well drained, moderately steep soil is on the side slopes along natural drainageways or in deep ravines in the uplands. The surface is convex, and slopes are 50 to 250 feet long. Areas range from 2 to 30 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is dark brown and dark yellowish brown silty clay loam and silt loam about 39 inches thick. The underlying material to a depth of 60 inches is yellowish brown, very friable silt loam. In wooded areas the surface layer is as thin as 3 inches and is black.

Permeability is moderate, and available water capacity is high. Runoff is rapid in most areas but is medium in wooded areas. The surface layer is neutral or slightly acid, and the subsoil is medium acid. The content of organic matter is low or moderate. The supply of available potassium is low, and the supply of available phosphorus is medium or high.

Almost all areas are cropped, pastured, or wooded. This soil has fair potential for cultivated crops and good potential for pasture and woodland. It has poor potential for building site development and sanitary facilities.

Suitability for corn, soybeans, and small grain is only fair because erosion is a severe hazard. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by

short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Erosion is a hazard, however, in areas where trees are newly planted. Cultivating or spraying helps to control plant competition. Pruning and thinning help to establish and maintain a good stand of trees.

This soil is poorly suited to building site development and sanitary facilities. The moderately steep slope is a severe limitation on building sites. Erosion control is needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent damage from frost action and low strength. Lateral seepage is a hazard unless the design of septic tank absorption fields overcomes the slope.

The capability subclass is IVe.

401D2—Mt. Carroll silt loam, 12 to 18 percent slopes, eroded. This well drained, moderately steep soil is on the side slopes along natural drainageways or river valleys in the uplands. The surface is convex, and slopes 50 to 250 feet long. Areas are 2 to 36 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is dark yellowish brown and yellowish brown silt loam about 22 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. In some areas it is silty clay loam.

Permeability is moderate, and available water capacity is high. Runoff is rapid in most areas but is medium in wooded areas. The surface layer is neutral or slightly acid, and the subsoil is medium acid. The content of organic matter is low or moderate. The supply of available potassium is low, and the supply of available phosphorus is medium or high.

Almost all areas are cropped, pastured, or wooded. This soil has fair potential for cultivated crops and good potential for pasture and woodland. It has fair potential for building site development and poor potential for sanitary facilities.

Suitability for corn, soybeans, and small grain is only fair because the hazard of erosion is severe. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Erosion is a hazard, however, in areas where trees are newly planted. Cultivating or spraying controls plant competition. Pruning and thinning help to establish and maintain a good stand of trees.

This soil is poorly suited to building site development and sanitary facilities. The moderately steep slope is a severe limitation on building sites. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage resulting from frost action and low strength. Lateral seepage is a hazard unless the design of septic tank absorption fields overcomes the slope.

The capability subclass is IVe.

401E—Mt. Carroll silt loam, 18 to 25 percent slopes. This steep, well drained soil is on the sides of small ravines and on the walls of stream valleys. Slopes are convex and are 50 to 250 feet long. Areas are generally long and narrow and range from 2 to 20 acres in size. In places small gullies have formed.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is dark brown and dark yellowish brown silt loam and silty clay loam about 32 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam.

Permeability is moderate, and available water capacity is high. Runoff is medium or rapid. The surface layer is slightly acid or neutral, and the subsoil is medium acid. The content of organic matter is low or moderate. The supply of available potassium is low, and the supply of available phosphorus is medium or high.

Most areas are pastured or wooded. This soil has poor potential for cultivated crops and fair potential for pasture and woodland. It has poor potential for building site development and sanitary facilities.

This soil is poorly suited to cultivated crops. Erosion is a severe hazard in cultivated areas.

Suitability for pasture and hay is fair. Pastures generally are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. They can be improved by seeding legumes or by planting a mixture of suitable legumes and grasses. Applications of fertilizer help to establish and maintain the grasses. Proper stocking rates and deferred grazing maintain a good plant cover and thus help to control erosion.

Suitability for woodland is fair. Weed control and pruning and thinning help to control plant competition. Erosion is a hazard if the plant cover is removed. Measures

that control erosion are needed in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities. Erosion is a hazard on building sites. Local roads and streets that are built on the contour divert runoff. Building them on the contour helps to control erosion. Lateral seepage is the main concern if sanitary facilities are installed on this soil.

The capability subclass is VIe.

463—Minneiska loam, occasionally flooded. This level, moderately well drained soil is on bottom land along the major streams. In some areas it is separated from the stream channel by a narrow area of sandy riverwash. In most areas a few stones are on the surface. Areas range from 2 to 20 acres in size.

Typically, the surface soil is black and very dark grayish brown loam about 36 inches thick. The subsoil is dark grayish brown sandy loam about 3 inches thick. The underlying material to a depth of 60 inches is dark grayish brown gravelly coarse sand.

Included with this soil in mapping are small areas of Root soils in similar positions on the landscape. The underlying material of the Root soils is dominantly channery to flaggy material. These soils make up about 5 percent of most mapped areas.

Permeability is moderately rapid in the Minneiska soil, and available water capacity is moderate. Runoff is slow; most of the water is absorbed by the soil. The content of organic matter is high. The soil is mildly alkaline throughout, and the content of calcium carbonate is as high as 6 percent. Natural fertility is low or medium. The seasonal high water table is at a depth of 3 to 6 feet.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and woodland. It has poor potential for building site development and most sanitary facilities.

This soil is well suited to corn and soybeans, but floodwater can damage the crop. A subsurface drainage system is needed. Measures that control weeds are needed in areas where floodwater spreads seeds. Small grain tends to lodge because of the added moisture. Upstream flood-control structures can keep meandering streams from cutting into cropland. If the soil is tilled in the fall, clods break up in the winter and seedbeds can be prepared earlier in the spring.

This soil is well suited to pasture. Kentucky bluegrass and similar grasses are suitable, but they are not highly productive because they tend to be dormant in the summer. Pastures can be improved by introducing legumes, such as birdsfoot trefoil and alfalfa, or by planting water tolerant grasses, such as Garrison creeping foxtail. Controlled grazing is needed when the surface layer is wet.

This soil is well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, or by spraying, cutting, or girdling. The hazard of flooding is minimal in wooded areas.

Because it is occasionally flooded and wet, this soil generally is unsuitable as a site for buildings and sanitary facilities. Building local roads above the water table helps to prevent the damage caused by frost action.

The capability subclass is IIw.

465—Kalmarville silt loam. This level, poorly drained soil is on low lying bottom land along the major streams. It is frequently flooded. The surface generally is plane, but in shallow remnant stream channels it is concave. Areas range from 100 to 1,000 feet in width.

Typically, the surface soil is about 43 inches thick. It is very dark gray silt loam that has many strata of dark gray silt loam and fine sandy loam. The underlying material to a depth of 60 inches is dark gray sand. In some areas it has strata of silt loam or channery or flaggy material.

Included with this soil in mapping are sandy alluvial soils, generally on the edges of the mapped areas. These soils make up about 10 percent of this unit.

Permeability and available water capacity are moderate in the Kalmarville soil. Runoff is slow. The soil is mildly alkaline or neutral throughout. The supply of available phosphorus and potassium is low or medium. The content of organic matter is moderate. The seasonal high water table is within 1 foot of the surface.

Most areas are pastured or wooded. This soil has fair potential for pasture and woodland. It has poor potential for cultivated crops, building site development, and sanitary facilities.

Suitability for pasture is fair. Kentucky bluegrass is established easily and naturally, but it is not highly productive. A greater amount of better quality forage can be produced if legumes, such as alfalfa and birdsfoot trefoil, are introduced. The sod should not be disturbed when the legumes are seeded. Water tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, grow well. Weeds, such as thistles and other broadleaves, are frequently carried in by floodwater. Controlling the weeds is difficult. It is essential prior to renovation. The pasture should not be grazed when wet.

Some areas of this soil are in cultivated fields that are dominated by other soils. If cultivated, they can be easily managed by the usual tillage methods. Many of these areas are used as grassed waterways.

Suitability for woodland is fair. Seedlings can survive and grow well only if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, by applications of herbicide, or by cutting or girdling.

Because it is wet and is frequently flooded, this soil generally is unsuitable as a site for buildings and sanitary facilities. It also is unsuitable as a site for recreation areas, such as campsites and playgrounds.

The capability subclass is Vw.

467—Sawmill silty clay loam. This level, poorly drained soil is on alluvial flood plains. It is frequently

flooded. Areas are typically long and narrow and are parallel to streams. They range from 5 to 50 acres in size.

Typically, the surface soil is black silty clay loam about 30 inches thick. The subsoil is dark gray silty clay loam about 11 inches thick. The underlying material to a depth of 65 inches is gray silty clay loam.

Included with this soil in mapping are soils in low lying depressions that are wet and seepy. These soils make up as much as 5 percent of some mapped areas.

Water and air move through the Sawmill soil at a moderately slow rate. Available water capacity is very high. Runoff is slow. The surface layer and subsoil are neutral or slightly acid. The content of organic matter is high. The supply of available phosphorus and potassium is medium. The seasonal high water table is within a depth of 2 feet. It restricts the depth to which roots can penetrate.

Most areas are cropped. This soil has fair to good potential for cultivated crops, hay, and pasture. It has poor potential for building site development and sanitary facilities.

Suitability for corn and soybeans is only fair because floodwater can damage the crop. A subsurface drainage system is needed. Measures that control weeds are needed in areas where floodwater spreads seeds. Small grain tends to lodge because of the added moisture. Upstream flood-control structures can keep meandering streams from cutting into cropland. If the soil is tilled in the fall, clods break up in the winter and seedbeds can be prepared earlier in the spring.

This soil is well suited to pasture. Kentucky bluegrass and similar grasses are suitable, but they are not highly productive because they tend to be dormant in the summer. Pastures can be improved by introducing legumes, such as birdsfoot trefoil and alfalfa, or by planting water tolerant grasses, such as Garrison creeping foxtail. Controlled grazing is needed when the surface layer is wet.

Because it is frequently flooded and wet, this soil generally is unsuitable as a site for buildings and sanitary facilities. Building local roads above the water table helps to prevent the damage caused by frost action.

The capability subclass is IIw.

468—Otter silt loam, channeled. This nearly level, very poorly drained soil is in upland drainageways, in areas that generally are very seepy and commonly are cut by small streams. It is frequently flooded (fig. 7). The areas are 100 to 300 feet wide and are 2 to 30 acres in size.

Typically, the surface soil is black and very dark gray silt loam and silty clay loam about 38 inches thick. The underlying material to a depth of 65 inches is greenish gray silt loam.

Water and air move through this soil at a moderate rate. Available water capacity is very high, and runoff is slow. The surface layer dominantly is slightly acid or neutral. The supply of available phosphorus and potassium is low or medium. The content of organic matter is high. The seasonal high water table is within a depth of 2 feet. It restricts the depth to which roots can penetrate.

Most areas are left idle because of the extreme wetness and the flooding. Some areas are pastured or have been drained and are used as cropland. This soil has fair to poor potential for cultivated crops, pasture, and woodland. It has poor potential for building site development and sanitary facilities.

Suitability for pasture is fair. Kentucky bluegrass can be established easily and naturally, but this grass is not highly productive. A larger amount of better quality forage can be obtained if legumes, such as alfalfa and birdsfoot trefoil, are introduced. The sod should not be disturbed when the legumes are seeded. Water tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, grow well. Weeds, such as thistles and other broadleaves, are frequently carried in by floodwater. Controlling the weeds is difficult. It is essential prior to renovation. The pasture should not be grazed when wet.

Some areas of this soil are in cultivated fields that are dominated by other soils. If cultivated, they are easily managed by the usual tillage methods. Many of these areas are used as grassed waterways.

Suitability for woodland is fair. Seedlings can survive and grow well only if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, by applications of herbicide, or by cutting or girdling.

Because it is wet and is frequently flooded, this soil generally is unsuitable as a site for buildings and sanitary facilities. It also is unsuitable as a site for recreation areas, such as campsites and playgrounds.

The capability subclass is Vw.

471—Root silt loam. This very gently sloping, poorly drained soil is on flood plains in narrow, bedrock-controlled ravines that are tributaries of the major rivers. Small creeks meander through the flood plains. The soil is frequently flooded. In places many scattered rock fragments are on the surface. Areas generally are long and are 50 to 400 feet wide. They range from 5 to 40 acres in size.

Typically, the surface soil is about 34 inches thick. It is very dark gray silt loam that has many thin, dark grayish brown strata. The underlying material to a depth of 50 inches is very dark gray channery loam. In places as much as 6 inches of muck is in the lower part of the surface layer.

Included with this soil in mapping are soils that do not have a water table within 5 feet of the surface. Also included are small seepy areas. Included soils make up as much as 10 percent of most mapped areas.

Permeability is moderate in the upper part of the Root soil and very rapid in the lower part. Available water capacity is moderate. The seasonal high water table is within a depth of I.5 feet. The surface layer is neutral or

Figure 7.—An area of Otter soils. These soils are flooded for brief periods after heavy rains.

mildly alkaline. The content of organic matter is moderate. The supply of available phosphorus and potassium is low or medium.

Most areas are pastured or wooded. This soil has fair potential for pasture, woodland, and wetland wildlife habitat. It has poor potential for cultivated crops, building site development, and sanitary facilities.

Suitability for pasture is fair. Kentucky bluegrass can be established easily and naturally, but this grass is not highly productive. A larger amount of better quality forage can be obtained if legumes, such as alfalfa and birdsfoot trefoil, are introduced. The sod should not be disturbed when the legumes are seeded. Water tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, grow well. Weeds, such as thistles and other broadleaves, are frequently carried in by floodwater. Controlling the weeds is difficult. It is essential prior to renovation. The pasture should not be grazed when wet.

Some areas of this soil are in cultivated fields that are dominated by other soils. If cultivated, they can be easily managed by the usual tillage methods. Many of these areas are used as grassed waterways.

Suitability for woodland is fair. Seedlings can survive and grow well only if competing vegetation is controlled or removed. Plant competition can be controlled by site preparation, by prescribed burning, by applications of herbicide, or by cutting or girdling.

Because it is wet and is frequently flooded, this soil generally is unsuitable as a site for buildings and sanitary facilities. It also is unsuitable as a site for recreation areas, such as campsites and playgrounds.

The capability subclass is Vw.

472B—Channahon loam, 1 to 6 percent slopes. This shallow, gently sloping, well drained soil is on slight rises or low knolls on bedrock-controlled uplands. The surface is convex. Areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface soil is very dark brown and very dark grayish brown loam about 12 inches thick. The subsoil is dark brown loam about 3 inches thick. About 5 percent of this layer is rock fragments and flagstones. The underlying material is hard bedrock (fig. 8). In places the upper part of the bedrock is soft. In some areas the content of rock fragments and flagstones is as much as 35 percent in the upper part of the soil. In other areas the surface layer is sandy loam.

Water and air move through this soil at a moderate rate. Available water capacity is low, and runoff is medium. The surface layer is slightly acid to mildly alkaline. The supply of available phosphorus and potassium is low. The content of organic matter is moderate. The depth to which roots can penetrate is restricted by the underlying bedrock.

Most areas are farmed. This soil has fair potential for cultivated crops, hay, pasture, and building site development. It has poor potential for sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard unless the soil is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

Suitability for pasture is only fair because this soil is droughty. Keeping pastures in good condition is difficult. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is shallow over bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIIe.

472C—Channahon loam, 6 to 12 percent slopes. This shallow, sloping, well drained soil is on slightly convex side slopes in the uplands. Areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is dark yellowish brown loam about 8 inches thick. The underlying material is hard bedrock. In places the upper part of the bedrock

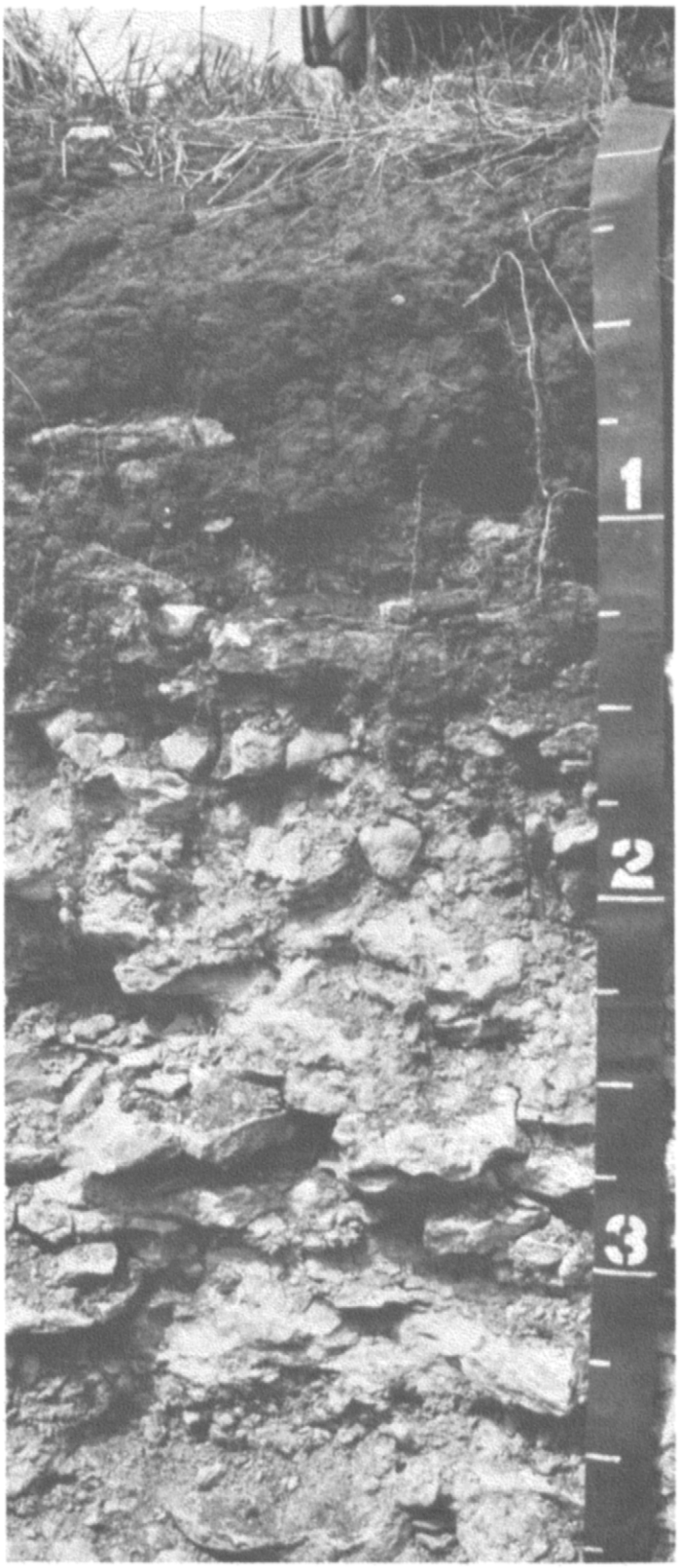


Figure 8.—Profile of Channahon loam, 1 to 6 percent slopes. This soil is shallow over bedrock.

is soft. In some areas the content of rock fragments and flagstones is as much as 35 percent in the upper part of the soil. In other areas the surface layer is sandy loam.

Water and air move through this soil at a moderate rate. Available water capacity is low, and runoff is medium or rapid. The surface layer and subsoil are slightly acid to mildly alkaline. The supply of available phosphorus and potassium is low. The content of organic matter is moderate. The depth to which roots can penetrate is restricted by the underlying bedrock.

Most areas are farmed. This soil has fair potential for cultivated crops, hay, pasture, and building site development. It has poor potential for sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard unless the soil is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

Suitability for pasture is only fair because this soil is droughty. Keeping pastures in good condition is difficult. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is shallow over bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IVe.

473D—Dorerton loam, 12 to 25 percent slopes. This moderately steep and steep, well drained soil is on the plane or convex upper side slopes and shoulders in valleys on uplands. A few limestone fragments are on the surface in most areas. Slopes are 50 to 250 feet long. Areas are long and narrow and range from 2 to 15 acres in size.

Typically, the surface layer is very dark gray loam about 6 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The subsoil is about 28 inches thick. The upper 14 inches is brown loam and clay loam, and the lower 14 inches is dark brown channery loam. The underlying material to a depth of 60 inches is very pale brown very flaggy loamy sand.

Included with this soil in mapping are areas of Elbaville soils in similar positions on the landscape. These soils have a thicker surface layer and subsoil than is typical in the Dorerton soil. They make up as much as 10 percent of some mapped areas.

Water and air move through the Dorerton soil at a moderate rate. Available water capacity is low. Runoff is rapid. The content of organic matter is low. The supply of available phosphorus and potassium also is low. The surface layer is medium acid to neutral, and the subsurface layer and subsoil are slightly acid to strongly acid.

Most areas are wooded or pastured. This soil has fair potential for woodland and pasture and poor potential for cultivated crops, building site development, and sanitary facilities. It has fair potential for woodland wildlife habitat.

Suitability for pasture is fair. The less productive grasses, such as Kentucky bluegrass, are dominant on overgrazed pastures. These pastures can be improved by introducing legumes, such as birdsfoot trefoil and alfalfa, or by planting mixtures of alfalfa and bromegrass. Overgrazed areas are highly susceptible to erosion. Pasture rotation and controlled grazing reduce the risk of erosion. Applications of lime and fertilizer improve productivity.

Suitability for woodland is only fair because plant competition is severe. Weed control and pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed. Measures that control erosion are needed in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities because it is moderately steep and steep. Measures that control erosion are needed during construction. The effluent from sanitary facilities can pollute underground water supplies.

The capability subclass is VIe.

473F—Dorerton loam, 25 to 40 percent slopes. This somewhat excessively drained, very steep soil is on the sides of long, narrow ravines in the uplands. Slopes are plane or convex and are about 100 to 300 feet long. Few to common scattered flagstones and limestone fragments are on the surface.

Typically, the surface layer is very dark brown loam about 3 inches thick. The subsurface layer is dark grayish brown and dark brown loam about 7 inches thick. The subsoil is about 20 inches thick. The upper 8 inches is brown and dark brown loam, and the lower 12 inches is dark brown very channery clay loam. The underlying material to a depth of 60 inches is very flaggy loamy sand. In places the lower part of the subsoil is not channery.

Included with this soil in mapping are small areas of the poorly drained Root soils on valley floors. Also included are small areas of Rock outcrop. Included areas are about 2 to 4 acres in size and make up about 10 percent of this unit.

Permeability is moderate in the Dorerton soil, and available water capacity is low. Runoff is rapid. The sur-

face layer is medium acid to neutral, and the subsurface layer and subsoil are slightly acid to strongly acid. The content of organic matter and the supply of available phosphorus and potassium are low.

Most areas are pastured or wooded. This soil has fair to poor potential for pasture and woodland. It has poor potential for cultivated crops, building site development, and sanitary facilities.

Suitability for woodland is fair. A good woodland understory reduces the runoff rate and helps to control erosion. In some areas timber can be harvested. These areas can revegetate naturally if the trees to be harvested are carefully selected. In most areas trees cannot be planted by machine because the soil is very steep. Pruning and thinning help to maintain a good stand.

This soil is poorly suited to pasture. Clearing trees from pastured areas or overgrazing the areas destroys the woodland understory. Destruction of the understory results in an increased runoff rate and in excessive erosion. Proper stocking rates and rotation grazing help to maintain an adequate plant cover and thus help to control erosion.

In some areas this soil is suitable as a site for paths and trails. Establishing the paths and trails on the contour helps to prevent excessive erosion and keeps gullies from forming.

This soil is very poorly suited to building site development and sanitary facilities because it is very steep.

The capability subclass is VIIe.

474B—Haverhill clay, 1 to 8 percent slopes. This very gently sloping to sloping, very poorly drained soil is on the narrow foot slopes of ravines and on the sides of stream valleys (fig. 9). Because of continuous seepage, most areas are characterized by a series of small mounds and some areas are subject to soil slippage. The areas range from 2 to 20 acres in size. A few scattered rock fragments and flagstones are on the surface.

Typically, the surface soil is clay about 13 inches thick. It is black in the upper part and very dark gray in the lower part. The subsoil is about 19 inches thick. It is very dark gray and dark olive gray clay and channery clay in the upper part and greenish gray clay in the lower part. The underlying material is greenish gray shale. In places the surface layer is muck as much as 24 inches thick.

Included with this soil in mapping are clayey soils in drainageways. These soils make up about 10 percent of most mapped areas. The content of rock fragments and flagstones is as much as 70 percent in the upper 3 to 4 feet of these soils.

Permeability is slow in the Haverhill soil, and available water capacity is high. Runoff is medium or slow. Because of seepage, the surface is wet most of the year. The content of organic matter is high. Natural fertility is medium. The soil is mildly alkaline throughout. The seasonal high water table is within a depth of 1 foot. The root zone is very shallow because of the water table and the underlying shale.

Most areas are left idle or are pastured. Some areas have been drained and are used as pasture. Others are used as a source of water. This soil has poor potential for most uses because of the wetness caused by seepage. It has fair potential for wetland wildlife habitat.

This soil is poorly suited to pasture. An extensive subsurface drainage system is needed to establish desirable forage. Water tolerant grasses, such as reed canarygrass and Garrison creeping foxtail, grow well. The pasture should not be grazed when the surface is wet.

This soil generally is unsuitable as a site for buildings and sanitary facilities because it is wet. It also is unsuitable as a site for recreation areas, such as campsites and playgrounds.

The capability subclass is VIw.

475B—Backbone sandy loam, 1 to 6 percent slopes. This gently sloping, well drained soil is on convex rises on bedrock-controlled uplands. Areas are oblong and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsurface layer is dark grayish brown sandy loam about 2 inches thick. The subsoil is about 19 inches thick. It is dark brown and yellowish brown sandy loam in the upper part and yellowish brown clay loam in the lower part. The underlying material is hard limestone that has weathered clay seams along broken joints. In places the slope is as much as 10 percent.

Water and air move through this soil at a moderately rapid rate. Available water capacity is low, and runoff is medium. The surface layer and subsurface layer are neutral, and the subsoil is slightly acid to strongly acid. The supply of available phosphorus is medium, and the supply of available potassium is low. The content of organic matter is moderate.

Most areas are farmed. This soil has fair potential for cultivated crops, pasture, woodland, and building site development. It has poor potential for sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard unless the soil is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

Suitability for pasture is only fair because this soil is droughty. Keeping pastures in good condition is difficult. Many pastures are dominated by Kentucky bluegrass,

Figure 9.—A dugout in an area of Haverhill clay, 1 to 8 percent slopes, on a foot slope in a stream valley.

which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for woodland is fair. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is moderately deep over bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIe.

476B—Frankville silt loam, 1 to 6 percent slopes. This gently sloping, well drained soil is on the summits of ridges above stream valleys. The surface generally is convex. Areas are long and narrow and range from 2 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark brown silt loam about 5 inches thick. The subsoil is dark brown, dark yellowish brown, or yellowish brown silty clay loam, silt loam, or silty clay about 25 inches thick. The underlying material is fractured limestone.

Water and air move through this soil at a moderate rate. Runoff is medium. Available water capacity is moderate. The surface layer and subsurface layer are medium acid to neutral, and the subsoil is dominantly medium acid or slightly acid. The supply of available phosphorus is medium or high, and the supply of available potassium is low. The content of organic matter is moderate. The depth to which roots can penetrate is restricted by the underlying bedrock.

Most areas are cropped. Some are pastured or wooded. This soil has fair to good potential for cultivated crops, pasture, and woodland. It has fair potential for building site development and poor potential for sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard unless the soil is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

Suitability for pasture is fair because this soil is droughty. Keeping pastures in good condition is difficult. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for woodland is fair. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is moderately deep over bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIe.

476C—Frankville silt loam, 6 to 12 percent slopes. This sloping, well drained soil is on the upper side slopes in the uplands. The surface is convex. Slopes are 50 to 250 feet long, and areas range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 22 inches thick. It is dark brown and dark yellowish brown silt loam and silty clay loam in the upper part and yellowish brown silty clay in the lower part. The underlying material is fractured limestone.

Permeability and available water capacity are moderate. Runoff is medium. The surface layer and subsurface layer are medium acid to neutral, and the subsoil is medium acid or slightly acid. The supply of available phosphorus is medium or high, and the supply of available potassium is low. The content of organic matter is low to moderate. The depth to which roots can penetrate is restricted by the underlying bedrock.

Most areas are cropped. Some are wooded or pastured. This soil has fair potential for cultivated crops and good potential for pasture and woodland. It has fair potential for building site development and poor potential for sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can

grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard unless the soil is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

Suitability for pasture is only fair because this soil is droughty. Keeping pastures in good condition is difficult. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of suitable grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

Suitability for woodland is fair. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. Measures that control erosion are needed. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because the soil is moderately deep over bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIIe.

477A—Littleton silt loam, 0 to 1 percent slopes. This level, somewhat poorly drained soil is on stream terraces and high bottom land adjacent to streams. It is subject to rare flooding. The surface generally is concave. Areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface soil is black and very dark brown silt loam about 28 inches thick. The subsoil is dark grayish brown and olive gray silt loam about 19 inches thick. The underlying material to a depth of 70 inches is olive gray silty clay loam. In some areas carbonates are within a depth of 40 inches.

Included with this soil in mapping are small areas of the poorly drained Garwin and Sawmill soils in drainageways. These soils make up about 10 percent of most mapped areas.

Water and air move through the Littleton soil at a moderate rate. Available water capacity is very high. Runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet. The soil is slightly acid or neutral throughout. The supply of available phosphorus and potassium is medium. The content of organic matter is high.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and hay. It has poor potential for building site development and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. A subsurface drainage system can improve cropland. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and legumes, such as alfalfa, birdsfoot trefoil, and alsike clover, grow well. Proper stocking rates, rotation grazing, and deferred grazing keep the more productive forage plants dominant.

This soil is poorly suited to building site development and sanitary facilities because it is wet and subject to flooding. The high water table can interfere with excavating for foundations and basements. Tile drains are needed around the foundations of basements to drain excess subsurface water. As a result of the high water table, the potential for frost action is high and septic tank absorption fields cannot function properly. Local roads and streets and parking lots should be constructed above the water table.

The capability class is I.

477B—Littleton silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is in concave areas on the head slopes and toe slopes of drainageways. Slopes are 50 to 400 feet long. Areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface soil is black and very dark brown silt loam about 32 inches thick. The subsurface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is dark brown and light yellowish brown silt loam about 21 inches thick. The underlying material to a depth of 71 inches is grayish brown silt loam.

Included with this soil in mapping are small areas of the poorly drained Garwin and Sawmill soils in drainageways. These soils make up about 8 percent of most mapped areas.

Water and air move through the Littleton soil at a moderate rate. Available water capacity is very high. Runoff is medium. The seasonal high water table is at a depth of 1 to 3 feet. The soil is neutral or slightly acid in the upper part. The supply of available phosphorus and potassium is medium. The content of organic matter is high.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, and hay. It has poor potential for building site development and sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling

erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In some areas slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, rotation grazing, and deferred grazing keep the more productive grasses dominant.

This soil is poorly suited to building site development and sanitary facilities. Tile drains are needed around basements to help remove excess subsurface water. Building local roads and streets on better suited base material and above the seasonal high water table helps to prevent the damage caused by frost action. Septic tank absorption fields can function properly only if their design overcomes the high water table.

The capability subclass is IIe.

478B—Coggon silt loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on summits on glaciated uplands. Areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is grayish brown silt loam about 4 inches thick. The subsoil is about 43 inches thick. The upper 6 inches is yellowish brown loam, and the lower 37 inches is brown clay loam. The underlying material to a depth of 65 inches is brown loam.

Included with this soil in mapping are areas of Dowagiac and Lilah soils. These soils are better drained than the Coggon soil and are higher on the landscape. They are underlain by coarse sand. They make up about 5 percent of most mapped areas.

Permeability is moderately slow in the Coggon soil, and available water capacity is high. Runoff is medium. The supply of available phosphorus is medium, and the supply of available potassium is low. The content of organic matter also is low. The surface layer and subsurface layer range from neutral to strongly acid, and the subsoil is medium acid or strongly acid.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, woodland, and building site development. It has fair potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In some areas slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, rotation grazing, and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees.

Suitability for sanitary facilities is fair. Septic tank absorption fields should be large enough to function properly in the moderately slowly permeable underlying material. The soil is well suited to building site development. Better suited material is needed, however, to strengthen the base of local roads and streets.

The capability subclass is IIe.

479—Floyd silt loam, 1 to 4 percent slopes. This very gently sloping, somewhat poorly drained soil is in plane or slightly concave areas on the head slopes above upland drainageways. Areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface soil is about 22 inches thick. It is black silt loam and clay loam in the upper part and very dark brown silt loam and very dark grayish brown loam in the lower part. The subsoil is dark grayish brown, olive brown, and yellowish brown loam about 28 inches thick. The underlying material to a depth of 65 inches is yellowish brown loam. In some areas a layer of loamy sand as much as 10 inches thick is in the subsoil or the underlying material.

Permeability is moderate, and available water capacity is very high. Runoff is medium. The seasonal high water table is at a depth of 2 to 4 feet. It restricts the depth to which roots can penetrate. The content of organic matter is high. The supply of available phosphorus and potassium is medium. The surface layer ranges from strongly acid to neutral, and the subsoil is slightly acid or medium acid.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, and hay. It has fair to poor potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main management needs are an artificial drainage system and measures that keep the soil in good tilth. If tilled in the fall, the soil warms up earlier in the spring and is accessible for earlier seedbed preparation. Grassed waterways are needed in some areas to divert runoff.

This soil is well suited to pasture. Most pastures can be improved by introducing mixtures of legumes and

grasses. Water tolerant grasses, such as Garrison creeping foxtail, and legumes, such as alsike clover and birdsfoot trefoil, grow well in undrained areas. Controlled grazing is needed when the surface layer is wet. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

Suitability for building site development is fair to poor. The high water table interferes with excavating for basements and foundations. Tile drains are needed around the foundations of basements. As a result of the high water table, the potential for frost action is high. Local roads and streets and parking lots should be constructed above the water table. The soil is poorly suited to sanitary facilities because it is seasonally wet. The high water table interferes with the functioning of septic tank absorption fields.

The capability subclass is IIw.

483A—Waukee loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces. The surface is convex. Areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 10 inches thick (fig. 10). The subsoil is about 38 inches thick. The upper part is dark brown loam, the next part is dark yellowish brown sandy loam, and the lower part is dark yellowish brown and yellowish brown gravelly loamy sand and coarse sand. The underlying material to a depth of 60 inches is very pale brown coarse sand. In places the surface layer and subsoil are silt loam.

Permeability is moderate in the upper part of this soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is slow. The content of organic matter is high. The supply of available phosphorus is medium, and the supply of available potassium is low. The surface layer is medium acid to neutral, and the subsoil is strongly acid to slightly acid. The depth to which roots can penetrate is restricted by the underlying coarse material.

Most areas are cropped. This soil has good potential for cultivated crops, hay, pasture, and building site development. It has poor potential for most sanitary facilities.

This soil is well suited to small grain, soybeans, and corn, but it holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. It is highly susceptible to erosion unless the surface is protected. A system of minimum tillage in which crop residue is left on the surface helps to control erosion.

Figure 10.—Profile of Waukee loam, 0 to 2 percent slopes. The surface layer is about 10 inches thick, and gravelly loamy sand is at a depth of about 31 inches.

This soil is well suited to pasture. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa, alsike clover, and birdsfoot trefoil grow well. Proper stocking rates, deferred grazing, and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to building site development. It can support buildings, but the sides of shallow excavations are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. The soil can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIs.

483B—Waukee loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on stream terraces. The surface is convex. Areas are irregularly shaped and range from 2 to 25 acres in size.

Typically, the surface layer is very dark brown loam about 10 inches thick. The subsoil is about 25 inches thick. It is dark brown and dark yellowish brown loam in the upper part and yellowish brown coarse sand in the lower part. The underlying material to a depth of 60 inches is yellowish brown sand. In some areas, especially along drainageways, the surface soil is as thick as 30 inches.

Permeability is moderate in the upper part of this soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The content of organic matter is high. The surface layer is neutral to medium acid, and the subsoil is strongly acid or medium acid. The supply of available phosphorus is medium, and the supply of available potassium is low. The depth to which roots can penetrate is restricted by the underlying coarse material.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, hay, and building site development. It has poor potential for most sanitary facilities.

This soil is well suited to small grain, corn, and soybeans. It is highly susceptible to erosion, however, unless a plant cover protects the surface. Contour farming and a system of minimum tillage in which crop residue is left on the surface help to control erosion. The amount of water available for plants is limited. As a result, the crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in the spring. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa and birdsfoot trefoil grow well. Proper stocking rates, deferred grazing, and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to building site development. The sides of shallow excavations, however, are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. The soil can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIe.

484C—Eyota sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is in concave areas on foot slopes near the base of valley walls. Areas are as much as 800 feet long and are about 100 to 300 feet wide. They range from 2 to 30 acres in size.

Typically, the surface soil is very dark grayish brown sandy loam about 24 inches thick. The subsoil is dark brown loam and silt loam about 26 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam.

Permeability is moderate, and available water capacity is high. Runoff is medium. The supply of available phosphorus and potassium is medium. The content of organic matter is moderate. The soil is slightly acid or neutral throughout.

Most areas are cropped. Some are pastured. This soil has good potential for cultivated crops, pasture, and hay. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

Suitability for building site development is fair. Hard-surfaced local roads or streets, parking lots, and driveways are likely to be damaged as a result of low strength

and frost action, especially in periods following a rainy fall. Providing better suited subbase material helps to prevent this damage. The soil is poorly suited to sanitary facilities because it is sloping.

The capability subclass is IIIe.

484E—Eyota loamy sand, 12 to 25 percent slopes. This moderately steep and steep, well drained soil is on foot slopes below valley walls. The surface is plane or slightly concave. Slopes are 50 to 250 feet long and extend horizontally around the base of hills. Areas range from 2 to 20 acres in size. Few to common stones are on the surface. They are as small as fragments and as large as flagstones.

Typically, the surface soil is about 24 inches thick. It is very dark grayish brown loamy sand in the upper part and very dark grayish brown fine sandy loam in the lower part. The subsoil is very dark grayish brown, dark brown, and dark yellowish brown silt loam and loam about 26 inches thick. The underlying material to a depth of 60 inches is yellowish brown fine sandy loam. In places it is loose sand or clayey or loamy residuum of limestone. In some areas underlying sand is as shallow as 30 inches.

Permeability is moderate, and available water capacity is high. Runoff is medium or rapid. The soil is slightly acid or neutral throughout. The content of organic matter is moderate. The supply of available phosphorus and potassium is low.

Most areas are pastured. Some are cropped. This soil has fair potential for pasture and hay. It has poor potential for cultivated crops, building site development, and sanitary facilities.

This soil is poorly suited to cultivated crops. Erosion is a severe hazard if cultivated crops are grown.

Suitability for pasture and hay is fair. Most pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Seeding suitable legumes or planting a mixture of suitable legumes and grasses improves the pasture. Applications of lime and fertilizer help to establish and maintain the grasses and legumes. Proper stocking rates and deferred grazing maintain a good plant cover and thus help to control erosion.

This soil is poorly suited to building site development and sanitary facilities. Erosion is a hazard on building sites. Local streets and roads that are built on the contour divert runoff. Building them on the contour helps to control erosion. Lateral seepage is the main concern if sanitary facilities are installed on this soil.

The capability subclass is VIe.

485—Lawler loam. This level, somewhat poorly drained soil is on stream terraces and in narrow drainageways. Areas are generally irregular in shape and range from 2 to 30 acres in size.

Typically, the surface soil is black loam about 16 inches thick. The subsoil is about 24 inches thick. It is dark grayish brown and dark brown loam in the upper part and brown loamy sand in the lower part. The underlying material to a depth of 70 inches is yellowish brown and pale brown loamy sand and sand. In some areas the surface layer is thin and is underlain by a dark grayish brown subsurface layer. In some narrow drainageways glacial till is at a depth of about 65 inches.

Permeability is moderate in the upper part of this soil and rapid in the lower part. Available water capacity is moderate. Runoff is slow or medium. The seasonal high water table is at a depth of 2 to 4 feet. The surface layer is medium acid to neutral, and the subsoil is medium acid or slightly acid. The content of organic matter is high. The supply of available phosphorus and potassium is low or medium.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and hay. It has fair to poor potential for building site development and poor potential for sanitary facilities.

This soil is well suited to small grain, soybeans, and corn, but it holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Because the surface layer dries out early in the year, the soil is accessible for fieldwork early in spring. It is highly susceptible to erosion unless the surface is protected. A system of minimum tillage in which crop residue is left on the surface helps to control erosion.

This soil is well suited to pasture. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves the pasture. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa, alsike clover, and birdsfoot trefoil grow well. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is poorly suited to building site development and sanitary facilities. On sites for buildings with basements, a drainage system, such as tile around the foundations and under the floor, is needed. Local roads and streets, parking lots, and driveways can be damaged by frost action. Better suited subbase material and a subsurface drainage system that removes trapped water help to prevent this damage. Septic tank absorption fields should be installed above the water table. A special design is needed. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIs.

486—Marshan silt loam, depressional. This nearly level, very poorly drained soil is on low terraces along streams. It is frequently flooded. Areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface soil is black silty clay loam about 12 inches thick. The subsoil is dark grayish brown or grayish brown silty clay loam or loam about 17 inches

thick. The underlying material to a depth of 60 inches is grayish brown and strong brown gravelly coarse sand and coarse sand.

Permeability is moderate in the surface layer and subsoil and rapid in the underlying material. Available water capacity is moderate. Runoff is slow. Reaction is neutral throughout the soil. The root zone typically is shallow because a seasonal high water table is within a depth of 1 foot. The content of organic matter is high. The supply of available phosphorus and potassium is low or medium.

Most areas are pastured. This soil has good to fair potential for pasture and cultivated crops and good potential for wetland wildlife habitat. It has poor potential for building site development and sanitary facilities.

Suitability for corn and soybeans is fair. Wetness can delay fieldwork early in the year, interfere with weed control, and delay harvesting. The high water table limits the effective rooting depth. If tilled in the fall, the soil warms up earlier in the spring and is accessible for earlier seedbed preparation. Grassed waterways are needed in some areas to divert runoff.

This soil is well suited to pasture. Most pastures can be improved by introducing mixtures of legumes and grasses. Water tolerant grasses, such as Garrison creeping foxtail, and legumes, such as alsike clover and birdsfoot trefoil, grow well in undrained areas. Controlled grazing is needed when the surface layer is wet. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

This soil is poorly suited to building site development and sanitary facilities because it is wet and subject to flooding. As a result of the high water table, the potential for frost action is high and septic tank absorption fields cannot function properly. Local roads and streets can be designed so that they are not damaged by frost action.

The capability subclass is IIw.

487—Hoopeston sandy loam. This very gently sloping, somewhat poorly drained soil is on outwash plains and in areas of outwash deposits on uplands. Areas range from 2 to 15 acres in size.

Typically, the surface soil is about 18 inches thick. It is black sandy loam in the upper 10 inches and very dark brown loam in the lower 8 inches. The subsoil is dark grayish brown and dark brown sandy loam about 14 inches thick. The underlying material to a depth of 60 inches is brown and gray sand. In places it is grayish brown, firm loam or bluish gray clay over shale.

Included with this soil in mapping are poorly drained soils in narrow drainageways. These soils make up about 10 percent of most mapped areas.

Permeability is moderately rapid in the Hoopeston soil, and available water capacity is moderate. Runoff is medium. The surface layer is slightly acid or medium acid, and the subsoil is strongly acid to slightly acid. The supply of available phosphorus and potassium is low. The content of organic matter is high. The seasonal high water table is 1 to 3 feet below the surface.

Most areas are cropped. This soil has fair potential for cultivated crops, pasture, and hay. It has poor potential for building site development and most sanitary facilities.

Suitability for cultivated crops is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Because the surface layer warms up and dries out early in the year, the soil is accessible for fieldwork early in spring. It is highly susceptible to erosion unless it is protected by mulch tillage, contour farming, or other measures. The surface layer is susceptible to soil blowing, and seedlings can be damaged by blowing sand. Leaving crop residue on the surface and mixing part of the residue with the surface layer help to control soil blowing.

Suitability for pasture is fair. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates, deferred grazing, and rotation grazing keep the more productive forage plants dominant.

This soil is poorly suited to building site development and sanitary facilities. Wetness is the main limitation. On sites for buildings with basements, a drainage system, such as tile around the foundations and under the floor, is needed. Septic tank absorption fields should be installed above the water table. Special design is needed. Frost action can damage local roads and streets, parking lots, and driveways. Better suited subbase material and a subsurface drainage system that removes trapped water help to prevent this damage.

The capability subclass is IIs.

488F—Brodale flaggy loam, 25 to 40 percent slopes. This very steep, excessively drained soil is on the south- to west-facing slopes in valleys or ravines adjacent to rivers. Slopes are 50 to 300 feet long, and areas range from 5 to 20 acres in size.

Typically, the surface soil is very dark gray flaggy loam about 12 inches thick. The subsoil is dark brown flaggy loam about 12 inches thick. The underlying material is yellowish brown flaggy loamy very fine sand about 21 inches thick. Limestone bedrock is at a depth of about 45 inches. In some areas the content of flagstones and rock fragments ranges to only 35 percent in the surface layer and subsoil. In places shale is at a depth of 4 feet or more.

Included with this soil in mapping are small areas of soils that are less than 10 inches deep over bedrock. These soils make up about 10 percent of most mapped areas. Their position on the landscape is similar to that of the Brodale soil.

Permeability is moderate in the Brodale soil, and available water capacity is very low. Runoff is very rapid. The

surface layer is mildly alkaline or moderately alkaline. The content of organic matter is moderate. The supply of available phosphorus and potassium is low. The depth to which roots can penetrate is limited by the underlying bedrock.

Most areas are left idle or are pastured. This soil has poor to fair potential for pasture. It has poor potential for cultivated crops, building site development, and sanitary facilities.

Suitability for pasture is only fair because this soil is droughty. Most pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot summer months. Measures that foster the growth of short native prairie grasses, such as little bluestem and side-oats grama, increase the amount of summer forage. These measures include early grazing of the cool season grasses and deferment of grazing during the growth period of the warm season grasses. Overgrazing increases the runoff rate and thus results in serious erosion.

This soil is poorly suited to building site development and sanitary facilities because it is very steep. Extensive excavations are needed if the soil is used as a building site. The effluent from sanitary facilities can pollute ground water.

The capability subclass is VIIs.

488G—Brodale flaggy sandy loam, 40 to 80 percent slopes. This very steep, excessively drained soil is on south- to west-facing slopes in deeply intrenched valleys along the major rivers. Bedrock crops out in many areas. Slopes are 100 to 400 feet long, and areas range from 5 to 70 acres in size.

Typically, the surface soil is black flaggy sandy loam about 12 inches thick. The subsoil is dark brown very flaggy sandy loam about 12 inches thick. The underlying material is brown very flaggy sandy loam about 21 inches thick. Limestone bedrock is at a depth of about 45 inches.

Included with this soil in mapping are small areas of soils that are less than 10 inches deep over bedrock. These soils make up about 10 percent of most mapped areas. Their position on the landscape is similar to that of the Brodale soil.

Permeability is moderate in the Brodale soil, and available water capacity is very low. Runoff is very rapid. The surface layer is mildly alkaline or moderately alkaline. The content of organic matter is moderate. The supply of available phosphorus and potassium is low. The depth to which roots can penetrate is limited by the underlying bedrock.

Most areas are pastured or left idle. This soil has poor to fair potential for pasture. It has poor potential for cultivated crops, building site development, and sanitary facilities.

This soil is poorly suited to pasture because it is droughty. Most pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot summer months. Measures that foster the growth of short native prairie grasses, such as little bluestem and side-oats grama, increase the amount of summer forage. These measures include early grazing of the cool season grasses and deferment of grazing during the growth period of the warm season grasses. Overgrazing increases the runoff rate and thus results in serious erosion.

This soil is poorly suited to building site development and sanitary facilities because it is very steep. Extensive excavating is needed if the soil is used as a building site. The effluent from sanitary faciltiies can pollute ground water.

The capability subclass is VIIIs.

489A—Atkinson loam, 0 to 1 percent slopes. This level, well drained soil is on the plane or slightly concave summits of hills in the uplands. Areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface soil is very dark brown and very dark grayish brown loam about 13 inches thick. The subsoil is dark brown or yellowish brown loam or clay loam about 28 inches thick. The underlying material is limestone bedrock. In places the surface layer and subsoil are thinner and lighter colored.

Included with this soil in mapping are soils in which the upper 30 inches is sandy loam. These soils make up 5 to 10 percent of most mapped areas. Their position on the landscape is similar to that of the Atkinson soil.

Permeability is moderate in the Atkinson soil, and available water capacity is high. Runoff is slow. The content of organic matter is high. The supply of available potassium and phosphorus is medium. The surface layer is medium acid to neutral, and the subsoil is dominantly slightly acid or medium acid.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, and hay. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. It has few limitations as cropland. Crop residue management keeps soil losses to a minimum and allows for the maximum infiltration of rainfall. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Pastures in poor condition can be renovated by reseeding with mixtures of grasses and legumes. Bromegrass and orchardgrass and legumes, such as alfalfa, birdsfoot trefoil, and alsike clover, grow well. Proper stocking rates and rotation and deferred grazing keep the more productive forage plants dominant.

Suitability for building site development is fair. This soil can support buildings, but the underlying bedrock interferes with excavating for foundations and basements. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because of the limited depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability class is I.

489B—Atkinson loam, 1 to 6 percent slopes. This gently sloping, well drained soil is on plane or slightly convex summits in the uplands. Areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface soil is very dark grayish brown and dark brown loam about 15 inches thick. The subsoil is about 30 inches thick. The upper 19 inches is dark yellowish brown and yellowish brown loam, and the lower 11 inches is yellowish brown clay loam. Limestone bedrock is at a depth of about 45 inches. In some areas the slope is as much as 12 percent.

Included with this soil in mapping are small areas of soils in which the upper 30 inches is sandy loam. These soils make up less than 5 percent of this unit. Their position on the landscape is similar to that of the Atkinson soil.

Permeability is moderate in the Atkinson soil, and available water capacity is high. Runoff is medium. The content of organic matter is high. The supply of available potassium and phosphorus is medium. The surface layer is neutral to medium acid, and the subsoil is slightly acid or medium acid.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, and hay. It has fair potential for building site development and poor potential for sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In some areas slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because of the limited depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIe.

491B—Waucoma loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on summits and side slopes on bedrock-controlled uplands. Areas range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The subsurface layer is dark brown loam about 6 inches thick. The subsoil is about 43 inches thick. It is dark yellowish brown and yellowish brown, friable loam in the upper part and yellowish brown clay in the lower part. The underlying material is partly weathered bedrock. In some small areas the slope is as much as 10 percent.

Permeability is moderate, and available water capacity is high. Runoff is medium. The content of organic matter is moderate. The supply of available potassium and phosphorus is medium. The surface layer is neutral or slightly acid, and the upper part of the subsoil is medium acid.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and woodland. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In some areas slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because of the limited depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIe.

492B—Nasset silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on the summits of upland hills. The surface is convex. Most areas are 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 38 inches thick. It is dark brown and yellowish brown silt loam and silty clay loam in the upper part and dark

brown clay in the lower part. The underlying material is limestone.

Permeability and available water capacity are moderate. Runoff is medium. The surface layer is slightly acid or medium acid, and the subsoil is strongly acid to slightly acid. The supply of available phosphorus is medium to high, and the supply of available potassium is low. The content of organic matter is moderate.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and woodland. It has fair potential for building site development and for sanitary facilities.

This soil is well suited to cultivated crops, but it holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard unless the soil is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because of the limited depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIe.

492C—Nasset silt loam, 6 to 12 percent slopes. This sloping, well drained soil is on side slopes in the uplands. The surface is convex. Areas are circular and are about 15 acres in size. Slopes are 100 to 300 feet long.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown or yellowish brown silt loam or silty clay loam about 36 inches thick. The underlying material is hard, somewhat fractured limestone. In places the slope is as much as 18 percent.

Permeability and available water capacity are moderate. Runoff is medium. The surface layer is slightly acid or medium acid, and the subsoil is strongly acid to slightly acid. The supply of available phosphorus is medium to high, and the supply of available potassium is low. The content of organic matter is moderate.

Most areas are farmed. This soil has good potential for woodland, pasture, and cultivated crops. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to cultivated crops, but it holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. Erosion is a hazard unless the soil is protected by mulch tillage, contour farming, or other measures. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Many pastures are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Reseeding pastures with mixtures of grasses, such as bromegrass and orchardgrass, and legumes, such as alfalfa and birdsfoot trefoil, improves forage production. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedling mortality is slight, but plant competition is severe. Weed control, cultivation, and applications of herbicide help to remove competing plants. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed.

Suitability for building site development is fair. Measures that control erosion are needed. This soil can support foundations and buildings, but heavy machinery is needed for excavations in the bedrock. The soil is poorly suited to sanitary facilities. Installing septic tank absorption fields is difficult because of the limited depth to bedrock. Also, the effluent from sanitary facilities can seep through cracks in the bedrock and pollute ground water.

The capability subclass is IIIe.

493B—Oronoco loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on the summits of broad uplands. Areas generally are irregularly shaped. They range from 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is dark brown and dark yellowish brown loam about 44 inches thick. The underlying material to a depth of 77 inches is dark yellowish brown silt loam. In places limestone or loamy glacial till is at a depth of 6 feet or more.

Permeability is moderate, and available water capacity is high. Runoff is medium. The surface layer is neutral or slightly acid, and the subsoil is medium acid or slightly acid. The content of organic matter is high. The supply of available potassium and phosphorus is medium.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, woodland, and building site development. It has good potential for septic tank absorption fields but has poor potential for other sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. In some areas slopes are long and smooth enough for contour farming or terracing. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees.

This soil is well suited to building site development and septic tank absorption fields. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage resulting from frost action and low strength. Lateral seepage from septic tank absorption fields is a hazard unless the design of the fields overcomes the slope.

The capability subclass is IIe.

493C—Oronoco loam, 6 to 12 percent slopes. This sloping, well drained soil is on summits and side slopes in the uplands. The surface is convex. Slopes are 50 to 150 feet long, and areas range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam about 3 inches thick. The subsoil is brown, pale brown, or yellowish brown loam or fine sandy loam about 63 inches thick. The underlying material to a depth of 77 inches is light yellowish brown silt loam.

Permeability is moderate, and available water capacity is high. Runoff is medium. The surface layer is slightly acid or neutral, and the subsoil is slightly acid or medium acid. The content of organic matter is moderate. The supply of available potassium and phosphorus is medium.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, and woodland. It has fair potential for building site development and poor potential for most sanitary facilities.

This soil is well suited to corn, soybeans, and small grain. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation and deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

Suitability for building site development is fair. Measures that control erosion are needed during construction because this soil is highly susceptible to erosion if the plant cover is removed. Building local roads and streets on better suited base material helps to prevent the damage resulting from frost action and low strength. Lateral seepage from septic tank absorption fields is a hazard unless the design of the fields overcomes the slope.

The capability subclass is IIIe.

493D—Oronoco fine sandy loam, 12 to 18 percent slopes. This well drained, moderately steep soil is on the sides of upland knolls. The surface is convex. Slopes are 50 to 150 feet long, and areas range from 2 to 20 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is dark yellowish brown or yellowish brown fine sandy loam or loam about 35 inches thick. The underlying material to a depth of 60 inches is yellowish brown silt loam. Calcium carbonate is at a depth of 60 inches or more.

Permeability is moderate, and available water capacity is high. Runoff is rapid. The surface layer and subsoil are slightly acid or neutral. The supply of available potassium and phosphorus is medium. The content of organic matter is low.

Most areas are cropped or pastured. This soil has fair potential for cultivated crops and good potential for pasture and woodland. It has poor potential for building site development and sanitary facilities.

Suitability for corn, soybeans, and small grain is only fair because the hazard of erosion is severe. The main concern of management is controlling erosion, especially if row crops are grown or the surface is not protected by

crop residue. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities. Erosion is a hazard during construction. Shrinking and swelling and frost action are likely to damage hard-surfaced local roads and streets, parking lots, and driveways, especially in periods following a rainy fall. Providing suitable subbase material helps to prevent this damage.

The capability subclass is IVe.

495—Zumbro loamy sand. This nearly level, well drained soil is on high terraces on the flood plains along the major rivers. It is subject to rare flooding. Areas generally are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface soil is very dark brown and very dark grayish brown loamy sand about 48 inches thick. The underlying material to a depth of 60 inches is grayish brown sand.

Included with this soil in mapping are small areas of soils that have a seasonal high water table at a depth of 4 feet or less. These soils are in swales and drainageways. They make up less than 5 percent of most mapped areas.

Water and air move through the Zumbro soil at a rapid rate. Available water capacity is low. Runoff is slow. The soil is mildly alkaline to slightly acid throughout. Natural fertility is low, and the content of organic matter is moderate.

Most areas are pastured or wooded. Some are cultivated. This soil has fair potential for cultivated crops and good to fair potential for pasture and hay. It has poor potential for building site development and most sanitary facilities.

Suitability for small grain, soybeans, and corn is only fair because this soil holds a limited amount of water available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. It is highly susceptible to erosion unless the surface is protected. A system of minimum tillage in which crop residue is left on the surface helps to control erosion.

This soil is well suited to pasture. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa, alsike clover, and birdsfoot trefoil grow well. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to building site development. It can support buildings and local roads and streets, but the sides of shallow excavations are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls.

This soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIIs.

516A—Dowagiac loam, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces along streams. Areas range from 2 to 20 acres in size and are irregular in shape. In places common to many stones are on the surface.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. Below this is a thin subsurface layer of dark brown loam. The subsoil is about 22 inches thick. It is dark brown and yellowish brown loam and clay loam in the upper 18 inches and yellowish brown loamy coarse sand in the lower 4 inches. The underlying material to a depth of 60 inches is coarse sand.

Included with this soil in mapping are small areas of soils that have a seasonal high water table in the underlying material. These soils are in swales and drainageways. They make up as much as 10 percent of some mapped areas.

Permeability is moderate in the upper part of the Dowagiac soil and rapid in the underlying material. Available water capacity is moderate, and runoff is slow. The surface layer is medium acid to neutral, and the subsoil ranges from neutral to strongly acid. The content of organic matter is moderate. The supply of available phosphorus and potassium is low.

Most areas are farmed. This soil has fair to good potential for cultivated crops, pasture, and woodland. It has good potential for building site development and poor potential for most sanitary facilities.

Suitability for small grain, soybeans, and corn is only fair because this soil holds a limited amount of water

available for plants. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. It is highly susceptible to erosion unless the surface is protected. A system of minimum tillage in which crop residue is left on the surface helps to control erosion.

This soil is well suited to pasture. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa, alsike clover, and birdsfoot trefoil grow well. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedlings can survive and grow well, but control of plant competition is needed. Cultivation or applications of herbicide control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Measures that control erosion, such as planting on the contour, are needed if trees are planted.

This soil is well suited to building site development. It can support buildings, but the sides of shallow excavations are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. The soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIs.

516B—Dowagiac silt loam, 2 to 6 percent slopes. This well drained, gently sloping soil is on the summits of knolls. The surface is convex. Areas are irregular in shape and range from about 2 to 20 acres in size. In some areas many small stones are on the surface.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The subsurface layer is dark brown silt loam about 4 inches thick. The subsoil is about 35 inches thick. The upper 13 inches is dark brown, friable silt loam and loam, and the lower 22 inches is dark brown gravelly coarse sandy loam and gravelly loamy coarse sand. The underlying material to a depth of 60 inches is light yellowish brown coarse sand. In places brown loam glacial till is at a depth of 5 to 7 feet.

Included with this soil in mapping are soils that have a seasonal high water table in the underlying material. These soils are in drainageways and low swales. They make up as much as 10 percent of some mapped areas.

Permeability is moderate in the upper part of the Dowagiac soil and rapid in the underlying material. Available water capacity is moderate, and runoff is slow. The surface layer and subsurface layer are medium acid to neutral, and the subsoil ranges from neutral to strongly acid. The content of organic matter is moderate. The supply of available phosphorus and potassium is low.

Most areas are farmed. This soil has fair to good potential for cultivated crops, pasture, and woodland. It has good potential for building site development and poor potential for most sanitary facilities.

Suitability for small grain, corn, and soybeans is fair. This soil is highly susceptible to erosion unless a plant cover protects the surface. Contour farming and a system of minimum tillage in which crop residue is left on the surface help to control erosion. The amount of water available to plants is limited. As a result, the crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa and birdsfoot trefoil grow well. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedlings survive and grow well, but control of plant competition is needed. Cultivation or applications of herbicide control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Measures that control erosion, such as planting on the contour, are needed if trees are planted.

This soil is well suited to building site development. It can support buildings, but the sides of shallow excavations are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. The soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIs.

516C—Dowagiac sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is on the sides of knolls in the uplands. The surface is convex. Areas generally are long and narrow and range from 2 to 25 acres in size. Slopes are 50 to 200 feet long. In places many small stones are on the surface.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsoil is about 38 inches thick. The upper 8 inches is yellowish brown loam, and the lower 30 inches is yellowish brown gravel-

ly coarse sandy loam that has strata of gravelly loamy coarse sand. The underlying material to a depth of 60 inches is yellowish brown coarse sand. In places glacial till is at a depth of 5 to 7 feet.

Included with this soil in mapping are areas of Lilah soils in similar positions on the landscape. These soils are sandy in the upper part. They make up about 15 percent of this unit.

Permeability is moderate in the upper part of the Dowagiac soil and rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The surface layer is neutral to medium acid, and the subsoil is neutral to strongly acid. The content of organic matter is moderate. The supply of available phosphorus and potassium is low.

Most areas are cropped or wooded. This soil has fair potential for cultivated crops and good potential for pasture and woodland. It has fair potential for building site development and poor potential for most sanitary facilities.

Suitability for small grain, corn, and soybeans is fair. This soil is highly susceptible to erosion unless a plant cover protects the surface. Contour farming and a system of minimum tillage in which crop residue is left on the surface help to control erosion. The amount of water available to plants is limited. As a result, the crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. If corn or soybeans are grown, the plant population should be limited. This well drained soil is accessible for fieldwork early in spring. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. Overgrazed pastures are dominated by short, cool season grasses, such as Kentucky bluegrass. Reseeding with mixtures of suitable grasses and legumes improves forage production. Such grasses as bromegrass and orchardgrass and such legumes as alfalfa and birdsfoot trefoil grow well. Proper stocking rates and rotation grazing keep the more productive forage plants dominant.

This soil is well suited to woodland. Seedlings can survive and grow well, but control of plant competition is needed. Cultivation or applications of herbicide control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Measures that control erosion, such as planting on the contour, are needed if trees are planted.

This soil is well suited to building site development. It can support buildings, but the sides of shallow excavations are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. The soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIIe.

528B—Palms muck, 1 to 6 percent slopes. This gently sloping, very poorly drained soil is on toe slopes. As a result of seepage, the landscape is characterized by a series of small mounds. Springs are common. Areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface soil is about 33 inches thick. It is black and very dark brown muck that is high in content of mineral material. Below the surface soil is a buried soil that occurs as a black and very dark gray silty clay loam surface layer over greenish gray silty clay loam.

Included with this soil in mapping are soils that have a high content of calcium carbonate. These soils make up about 10 percent of most mapped areas. Their position on the landscape is similar to that of the Palms soil.

Permeability is moderately slow in the Palms soil. Available water capacity is very high. Runoff is slow. The supply of available phosphorus and potassium is high. The surface soil is neutral or mildly alkaline, and the buried soil is mildly alkaline. The seasonal high water table is within 1 foot of the surface.

Most areas are pastured or left idle. If drained, this soil has poor to fair potential for pasture. It has poor potential for building site development and sanitary facilities.

This soil is poorly suited to pasture. An extensive subsurface drainage system is needed to establish desirable forage. Water tolerant grasses, such as reed canarygrass and Garrison creeping foxtail, grow well. Pastures should not be grazed when the surface is wet.

This soil is too wet for building site development, sanitary facilities, and recreation areas, such as campsites and playgrounds.

The capability subclass is Vw.

593D—Elbaville silt loam, 12 to 18 percent slopes. This moderately steep, well drained soil is on the sides of shallow ravines on dissected uplands. The surface is convex or plane. Slopes are 50 to 250 feet long. Areas generally are long and narrow and range from 2 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 34 inches thick. The upper 23 inches is dark brown and yellowish brown silt loam and silty clay loam, and the lower 11 inches is dark brown silty clay and channery clay loam. The underlying material to a depth of 60 inches is flaggy loamy sand.

Included with this soil in mapping are Dorerton and Marlean soils in similar positions on the landscape. These soils have a thin layer of sediments over limestone material. They make up about 15 percent of most mapped areas.

Permeability is moderately slow in the upper part of the Elbaville soil and moderately rapid in the underlying material. Available water capacity is moderate. Runoff is rapid. The upper part of the soil is medium acid to

neutral, and the underlying material is mildly alkaline or moderately alkaline. The supply of available phosphorus and potassium and the content of organic matter are low.

Most areas are pastured or wooded. This soil has good potential for pasture and woodland and fair potential for cultivated crops. It has poor potential for building site development and sanitary facilities.

Suitability for corn, soybeans, and small grain is fair. The main concern of management is controlling erosion. Leaving crop residue on the surface helps to control erosion and increases the intake of surface water. Contour farming or terracing is effective in controlling erosion. Lime and fertilizer should be applied as indicated by soil tests.

This soil is well suited to pasture. As a result of overgrazing, however, many pastures are dominated by short, cool season grasses. Reseeding pastures with mixtures of suitable grasses and legumes, such as bromegrass and alfalfa, improves forage production. Applications of lime help to establish and maintain the grasses and legumes. Applications of fertilizer, proper stocking rates, and rotation or deferred grazing keep the more productive grasses dominant.

This soil is well suited to woodland. Seedling mortality is slight, but control of plant competition is needed. Cultivating or spraying helps to control weeds. Pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities. Measures that control erosion are needed during construction because the soil is highly susceptible to erosion if the plant cover is removed. Lateral seepage is a hazard if sanitary facilities are installed on this soil.

The capability subclass is IVe.

593E—Elbaville silt loam, 18 to 30 percent slopes. This steep and very steep, well drained soil is on the upper side slopes and shoulders of narrow ridges and ravines in the uplands. The surface is plane or convex. Slopes are 50 to 200 feet long. Areas are long and narrow and range from 2 to 25 acres in size.

Typically, the surface layer is black silt loam about 4 inches thick. The subsurface layer is dark grayish brown or grayish brown silt loam or silt about 6 inches thick. The subsoil is about 26 inches thick. The upper part is brown silt loam and silty clay loam, the next part is dark brown silty clay, and the lower part is dark brown very flaggy silty clay loam. The underlying material to a depth of 60 inches is yellowish brown very flaggy sandy loam.

Included with this soil in mapping are Dorerton and Marlean soils in similar positions on the landscape. These soils have a thin layer of sediments over limestone material. They make up about 10 percent of most mapped areas.

Permeability is moderately slow in the upper part of the Elbaville soil and moderately rapid in the underlying material. Available water capacity is moderate. Runoff is rapid. The upper part of the soil is medium acid to neutral, and the lower part is mildly alkaline or moderately alkaline. The content of organic matter and the supply of available potassium and phosphorus are low.

Most areas are native woodland or are pastured. This soil has fair to good potential for pasture and woodland and good potential for woodland wildlife habitat. It has poor potential for building site development and sanitary facilities.

Suitability for pasture is fair. The less productive grasses, such as Kentucky bluegrass, are dominant on overgrazed pastures. Introducing legumes, such as birdsfoot trefoil and alfalfa, or planting a mixture of alfalfa and bromegrass improves overgrazed pastures. The overgrazed areas are highly susceptible to erosion. Pasture rotation and controlled grazing help to control erosion. Applications of lime and fertilizer improve forage production.

Suitability for woodland is fair. Plant competition is severe. Weed control and pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard if the plant cover is removed. Measures that control erosion are needed in areas where trees are newly planted.

This soil is poorly suited to building site development and sanitary facilities because it is steep and very steep. Extensive cutting and filling is needed. Also, the effluent from sanitary facilities can pollute ground water.

The capability subclass is VIe.

898F—Brodale-Bellechester complex, 25 to 60 percent slopes. These very steep, excessively drained soils are on the sides of the major stream valleys. The slopes typically face south or west. Areas range from 5 to 50 acres in size. They are 50 to 60 percent Brodale soil and 30 to 40 percent Bellechester soil. The Brodale soil is on the upper convex side slopes. The less steep Bellechester soil is on the lower plane or concave foot slopes.

Typically, the Brodale soil has a surface layer of very dark gray flaggy sandy loam about 8 inches thick. The subsoil is dark brown flaggy sandy loam about 10 inches thick. The underlying material is flaggy loamy fine sand. Sandstone bedrock is at a depth of about 60 inches.

Typically, the Bellechester soil has a surface layer of very dark grayish brown loamy sand about 20 inches thick. The subsoil is dark brown or very pale brown loamy sand or sand about 18 inches thick. The underlying material to a depth of about 48 inches is yellow sand. White, soft sandstone bedrock is at a depth of 48 inches.

Included with these soils in mapping are Eyota, Lindstrom, and Sogn soils, which make up about 10 percent of most mapped areas. Eyota and Lindstrom soils typically are on the lower foot slopes. Sogn soils are on the shoulders of valley walls. Eyota and Lindstrom soils contain more clay than the Bellechester soil, and Sogn soils are less than 20 inches deep over limestone bedrock.

Permeability is rapid in the Bellechester soil and moderate in the Brodale soil. Available water capacity is low in the Bellechester soil and very low in the Brodale soil. Runoff is very rapid on the Brodale soil and medium on the Bellechester soil. The surface layer of both soils is mildly alkaline or moderately alkaline. The content of organic matter is moderate in both soils, and natural fertility is low. The depth to which roots can penetrate is restricted by the bedrock underlying the Brodale soil.

Most areas are left idle or are pastured. These soils have fair to poor potential for pasture and poor potential for building site development and sanitary facilities.

These soils are poorly suited to pasture. Clearing trees from pastured areas or overgrazing the areas destroys the woodland understory. Destruction of the understory increases the runoff rate and results in excessive soil losses. Proper stocking rates, deferred grazing, and rotation grazing help to maintain an adequate plant cover and thus help to control erosion.

Some areas can be used for paths and trails. Establishing the paths and trails on the contour helps to prevent excessive erosion and keeps gullies from forming.

These soils are very poorly suited to building site development and sanitary facilities because of the limited depth to bedrock and the very steep slope.

The capability subclass is VIIs.

973D—Brodale-Sogn complex, 12 to 25 percent slopes. These moderately steep and steep soils are on the sides of ravines, typically on south- to west-facing slopes. The excessively drained Brodale soil is on the lower back slopes, and the somewhat excessively drained Sogn soil is on the upper parts of the landscape. The Brodale soil typically makes up about 50 percent of this unit and the Sogn soil about 30 percent. The surface is convex. Slopes are 50 to 200 feet long. Areas generally are narrow and range from 2 to 15 acres in size.

Typically, the surface layer of the Brodale soil is very dark gray flaggy loam about 7 inches thick. The subsoil is dark brown very flaggy loam about 5 inches thick. The underlying material is channery loamy fine sand. Hard limestone is at a depth of about 45 inches. In places the bedrock is below a depth of 50 inches.

Typically, the surface layer of the Sogn soil is very dark gray loam about 15 inches thick. Limestone bedrock is at a depth of about 15 inches. In places it occurs as exposed rock ledges.

Permeability is moderate in the Brodale and Sogn soils. Available water capacity is very low. Runoff is rapid. The content of organic matter is moderate. The supply of available phosphorus and potassium is low. The soils are moderately alkaline or mildly alkaline throughout. The depth to which roots can penetrate is restricted by the rock fragments and the bedrock.

Most areas are pastured or left idle. These soils have fair to poor potential for pasture. They have poor potential for cultivated crops, building site development, and sanitary facilities.

Pastures that are overgrazed are dominated by the less productive, short, cool season grasses. Warm season grasses can be reestablished by seeding and by deferred grazing during the growth period of warm season plants. Controlled grazing reduces the runoff rate and the hazard of erosion.

Some areas can be used for scenic trails, and many areas are suitable sites for scenic overlooks. Trails should be established on the contour as much as possible because the soils are moderately steep and steep.

These soils are poorly suited to building site development and sanitary facilities because of the slope and the limited depth to bedrock. Building local roads on the contour helps to prevent excessive erosion. The effluent from sanitary facilities can pollute ground water.

The capability subclass is VIIc.

1013—Pits, quarry. This map unit occurs as areas that have been or are mined for limestone or sandstone. The areas range from 2 to 50 acres in size.

The relief, slope, drainage, texture, reaction, and profile characteristics vary greatly. In some areas unconsolidated material, such as bedrock fragments, is piled. Areas of water are in the deeper parts of some quarries.

If the topsoil is carefully stockpiled prior to quarrying, some areas can be reclaimed. The results of reclamation can vary, depending on the nature of the original soil, on the drainage, slope, and depth of the soil after reclamation, and on the intended use.

The limitations or hazards affecting building site development and sanitary facilities vary greatly. These include steep slopes, shallowness over bedrock, drainage, and the pollution of ground water by effluent from sanitary facilities. Onsite investigation is needed to determine the suitability for any intended use.

This map unit is not assigned to a capability class or subclass.

1029—Pits, gravel. This map unit occurs as areas that have been or are mined for sand or gravel. It consists of excavations, stockpiles of sand and gravel, areas of waste material, and some areas of water. The areas range from 2 to 20 acres in size.

Many areas are no longer mined. These areas can be reclaimed and used for other purposes, but extensive filling and grading is needed during reclamation. Some areas can be reclaimed for farming if topsoil is available for topdressing. Some can be developed for commercial, industrial, or residential uses. In many places wildlife habitat or recreation areas can be developed if a plant cover is established and the many ponds are used. Onsite investigation is needed to determine the suitability for any intended use.

This map unit is not assigned to a capability class or subclass.

1039—Urban land. This map unit occurs as level to gently sloping areas, mainly on stream benches but also

on flood plains and uplands, where more than 90 percent of the surface is covered with asphalt, concrete, or other impervious material. These areas have been developed for factories, shopping centers, warehouses, railroad yards, and parking lots. They generally range from 2 to more than 600 acres in size.

The soils in these areas have been so altered during construction that they cannot be identified. Some areas have been smoothed or filled.

Following rains, runoff is so rapid that it causes severe erosion unless it is channeled. It commonly flows into a storm drainage system. The water supply for lawns, trees, and shrubs is often low. Generally, plants grow only in narrow strips along sidewalks, between roadways, and in isolated islands. Less than 5 percent of the area has a plant cover. Onsite investigation is needed to determine the suitability and plan the development for specific uses.

This map unit is not assigned to a capability class or subclass.

1078—Udorthents. This map unit occurs mainly as nearly level areas where the natural soil has been removed or covered with other material. The areas range from 3 to 300 acres in size. The largest areas are in and around Rochester.

In most areas the surface layer is loamy. The underlying material is dominantly loamy alluvium or loamy glacial till. In some areas, the original surface layer has been removed and the underlying material is exposed.

Included with this unit in mapping are areas where the underlying material is sandy. Also included are sanitary landfills. Some of these areas are steeper than the Udorthents.

Permeability, drainage, and other soil properties vary greatly.

Most areas are used as sites for buildings. Some are farmed with adjoining soils. Because of the wide range in soil properties and behavior, onsite investigation and soil borings are needed to determine the suitability for any intended use.

This map unit is not assigned to a capability class or subclass.

1811B—Lamont-Racine complex, 2 to 6 percent slopes. These gently sloping, well drained soils are on uplands that in places are cut by narrow drainageways. The surface generally is convex. Areas range from 2 to 50 acres in size. They are about 40 to 60 percent Lamont soil and 20 to 40 percent Racine soil. The Lamont soil typically is on summits, and the Racine soil is on the lower parts of side slopes.

Typically, the Lamont soil has a very dark grayish brown sandy loam surface layer about 8 inches thick. The subsoil is about 20 inches thick. It is brown and yellowish brown loam in the upper part and yellowish brown sandy loam in the lower part. The underlying material to a depth of 60 inches is yellowish brown sand. In places the surface layer is very dark brown and is as much as 15 inches thick. In some areas the slope is as much as 10 percent.

Typically, the Racine soil has a very dark grayish brown loam surface layer about 8 inches thick. The subsoil is brown and yellowish brown clay loam about 34 inches thick. The underlying material to a depth of 60 inches is brown, firm loam till.

Permeability is moderately rapid in the upper part of the Lamont soil and very rapid in the underlying material. It is moderate in the Racine soil. Available water capacity is low in the Lamont soil and high in the Racine soil. Runoff is medium on both soils. The surface layer in both soils is slightly acid or medium acid, and the subsoil is medium acid or strongly acid. The content of organic matter and natural fertility are moderate to low.

Most areas are farmed. These soils have good to fair potential for cultivated crops, pasture, and woodland. The Lamont soil has poor potential and the Racine soil good potential for sanitary facilities. Both soils have good potential for building site development.

The main concern in managing cropland is the droughtiness of the Lamont soil. The crops selected for planting should be those that can grow in a droughty soil, that can be planted early in the year, and that mature before the less frequent rainfall late in summer. Both soils are highly susceptible to erosion unless they are protected by mulch tillage, contour farming, or other measures.

These soils are well suited to pasture. Most pastures have been overgrazed and are dominated by Kentucky bluegrass, which tends to be dormant during the hot, dry summer months. Introducing legumes, such as birdsfoot trefoil and alfalfa, or planting mixtures of suitable legumes and grasses improves forage production. Applications of lime and fertilizer help to establish and maintain the legumes and grasses.

These soils are well suited to woodland. Seedling mortality is slight, but plant competition is severe. Weed control and pruning and thinning help to establish and maintain a good stand of trees. Erosion is a hazard in bare areas where trees are newly planted.

These soils are well suited to building site development. The Lamont soil can support buildings and local roads and streets. Properly designing the buildings and roads and streets constructed on the Racine soil helps to prevent the damage resulting from frost action and low strength. The effluent from the sanitary facilities installed on the Lamont soil can pollute ground water.

The capability subclass is IIIe.

1812B—Terril loam, sandy substratum, 1 to 6 percent slopes. This gently sloping, moderately well drained soil is in slightly concave drainageways extending into gravelly areas on uplands. Slopes are 100 to 400 feet long. Areas range from 2 to 50 acres in size.

Typically, the surface soil is black, very dark brown, and very dark grayish brown loam about 31 inches thick.

The subsoil is dark brown loam about 14 inches thick. The underlying material to a depth of 60 inches is loose coarse sand. In places it is stratified.

Permeability is moderate in the upper part of this soil and rapid in the underlying material. Available water capacity is high. Runoff is medium. The surface layer is slightly acid or neutral. The content of organic matter is high. The supply of available phosphorus and potassium is medium.

Most areas are cropped. This soil has good potential for cultivated crops, pasture, hay, and building site development. It has poor potential for sanitary facilities.

This soil is well suited to corn, small grain, and grasses and legumes. The main concerns of management are controlling erosion and conserving moisture. Contour farming or a system of minimum tillage in which crop residue is left on the surface helps to control erosion and conserves moisture. In some areas slopes are long and smooth enough for terracing.

This soil is well suited to pasture. The less productive grasses, such as Kentucky bluegrass, invade overgrazed pastures. Introducing legumes or planting mixtures of suitable grasses and legumes improves forage production. Applications of fertilizer help to establish and maintain the grasses and legumes.

This soil is well suited to building site development. It can support buildings and local roads and streets, but the sides of shallow excavations are unstable. Caving of the sides can be prevented by enlarging the trenches or by installing temporary retaining walls. The soil is poorly suited to most sanitary facilities. It can easily absorb septic tank effluent, but the underlying material is a poor filter. As a result, septic tank absorption lines should be installed as close to the surface as possible. The effluent from sanitary facilities can pollute ground water.

The capability subclass is IIe.

1819G—Dorerton-Rock outcrop complex, very steep. This map unit is on the sides of the major stream valleys and the adjoining ravines. It is about 55 percent well drained Dorerton soil and 35 percent Rock outcrop. The Dorerton soil is on the upper slopes and on side slopes. The Rock outcrop is on the lower parts of the landscape. Slopes are 50 to 150 feet long. Areas range from 5 to 50 acres in size.

Typically, the Dorerton soil has a surface layer of very dark brown loam about 4 inches thick. The subsurface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 14 inches thick. The upper part is brown loam, and the lower part is dark brown clay loam and flaggy and channery clay loam. The underlying material to a depth of 60 inches is yellowish brown flaggy loamy sand. In places the soil is thicker and darker colored.

The Rock outcrop is dominantly limestone and dolomite. In some areas it is sandstone. In other areas it is mantled with a thin layer of loamy material.

Permeability is moderate in the Dorerton soil, and available water capacity is low. Runoff is medium to rapid. The surface layer is neutral, and the subsurface layer and subsoil are slightly acid to strongly acid. The content of organic matter is low.

Most areas are wooded or are left idle. Some are pastured. This map unit has poor potential for woodland, pasture, building site development, and sanitary facilities.

This map unit is best suited to permanent woodland. A good woodland understory reduces the runoff rate and thus helps to control erosion. In some areas timber can be harvested. These areas can revegetate naturally if the trees to be harvested are carefully selected. In most areas trees cannot be planted by machine because slopes are very steep. Pruning and thinning help to maintain a good stand.

This map unit is poorly suited to pasture. Clearing trees from pastured areas or overgrazing the areas destroys the woodland understory. Destruction of the understory increases the runoff rate and results in excessive soil losses. Proper stocking rates, deferred grazing, and rotation grazing help to maintain an adequate plant cover and thus prevent excessive erosion.

Some areas can be used for paths and trails. Establishing the paths and trails on the contour helps to control erosion and keeps gullies from forming.

This map unit is very poorly suited to building site development and sanitary facilities because of the stones and the very steep slopes.

The capability subclass is VIIe.

1832C—Ostrander-Dowagiac loams, 6 to 12 percent slopes. These sloping, well drained soils are on side slopes and summits above upland drainageways. The surface generally is convex. Slopes are 50 to 200 feet long. Areas range from 3 to 30 acres in size. They are about 55 percent Ostrander loam and 30 percent Dowagiac loam.

Typically, the surface soil of the Ostrander soil is very dark brown loam about 13 inches thick. The subsoil is dark yellowish brown and yellowish brown loam about 22 inches thick. The underlying material to a depth of 60 inches is firm, yellowish brown loam.

Typically, the surface layer of the Dowagiac soil is very dark grayish brown loam about 10 inches thick. The subsoil is about 24 inches thick. The upper 9 inches is dark brown loam, and the lower 15 inches is yellowish brown gravelly sandy loam and loamy sand. The underlying material to a depth of 60 inches is yellowish brown coarse sand that has strata of gravel.

Included with these soils in mapping are Lilah and Salida soils in similar positions on the landscape. These included soils are excessively drained. They are shallow to sand and gravel. They make up about 10 percent of most mapped areas.

Permeability is moderate in the Ostrander soil. It is moderate in the upper part of the Dowagiac soil and rapid in the underlying material. Runoff is medium on both soils. Available water capacity is moderately high. The subsoil is slightly acid to strongly acid. The content

of organic matter is moderate to high. The supply of available phosphorus and potassium is low or moderate.

Most areas are cropped. These soils have fair to good potential for cultivated crops, pasture, and woodland. They have fair potential for building site development and fair to poor potential for most sanitary facilities.

Suitability for cultivated crops is fair. The main concerns of management are controlling erosion and conserving moisture. Contour farming and a system of minimum tillage in which part of the crop residue is left on the surface and part is mixed with the surface layer help to control erosion and conserve moisture. Because the Dowagiac soil is droughty, the crops selected for planting should be those that mature before the less frequent rainfall late in summer.

These soils are well suited to pasture and hay. A cover of pasture plants or hay is effective in controlling erosion and runoff. Most pastures can be improved by planting a mixture of grasses and legumes, such as bromegrass and alfalfa. Rotation grazing helps to maintain a good plant cover. Applications of lime and fertilizer improve forage production.

These soils are suited to building site development. They can support buildings and local roads and streets. Runoff should be diverted from urban areas. If properly designed, local roads or streets can divert excess runoff to a large drainageway. Septic tank absorption fields function properly, but the effluent can pollute ground water.

The capability subclass is IIIe.

1846—Kato silty clay loam, depressional. This level, very poorly drained soil is on terraces and in drainageways along streams. It is occasionally flooded, and in many areas it receives seepage or overflow from small springs. Areas range from 2 to 30 acres in size.

Typically, the surface layer is black silty clay loam about 11 inches thick. The subsurface layer is very dark gray silty clay loam about 5 inches thick. The subsoil is dark gray, gray, and grayish brown silty clay loam about 34 inches thick. It has many dark brown or yellowish brown mottles. The underlying material to a depth of 70 inches is grayish brown gravelly loamy coarse sand and sand. In some areas loamy glacial till is at a depth of 50 inches.

Included with this soil in mapping are areas of soils in which the content of calcium carbonate is as much as 6 percent throughout the profile. These areas are 1/2 acre to 2 acres in size.

Permeability is moderate in the upper part of the Kato soil and rapid in the underlying material. Available water capacity is high. Runoff is slow. The supply of available phosphorus is medium, and the supply of available potassium is low. The content of organic matter is high. The surface layer and subsoil are neutral or mildly alkaline. The seasonal high water table is within a depth of 1 foot.

Most areas are permanent pasture. Some are cultivated. This soil has good potential for pasture and wetland wildlife habitat and fair potential for cultivated crops. It has poor potential for building site development and sanitary facilities.

If this soil is cropped, the main limitation is wetness, which restricts the depth to which roots can penetrate. The main management needs are an artificial drainage system and measures that maintain tilth. Returning crop residue to the soil helps to maintain tilth. If tilled in the fall, the soil warms up earlier in the spring and is accessible for earlier seedbed preparation. Applications of lime generally are needed. If possible, the lime should be worked into the subsoil. In some areas grassed waterways are needed to divert runoff.

Suitability for pasture is fair. Reseeding with suitable forage plants improves forage production. Such forage species as red clover, alsike clover, and timothy generally can withstand the acidity of the soil. Applications of lime are needed if alfalfa is grown. Controlled grazing and deferred grazing are needed when the surface layer is wet.

The high water table interferes with excavations and with the functioning of septic tank absorption fields. Also, it results in a high potential for frost action. If possible, drainage tile should be installed around basements. Local roads, parking lots, sidewalks, and driveways should be constructed above the water table. The effluent from septic tank absorption fields can pollute ground water.

The capability subclass is IIIw.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses

and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

By Dwayne J. Breyer, conservation agronomist, Soil Conservation Service.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; 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 presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

Approximately 330,000 acres in Olmsted County is cropland and pasture. This total includes the acreage on small hobby farms. Of a total of 280,000 acres of cropland, about 115,500 acres is used for corn grown for grain or silage, 45,000 acres for hay, 30,000 acres for soybeans, and 28,000 acres for oats. Wheat, barley, and canning crops, mainly peas and sweet corn, are grown on smaller acreages.

The acreage planted to corn has increased significantly over the past 10 years. Much of this increase is the result of a conversion from wetland pasture to cropland. The acreage planted to soybeans also has increased as a result of this conversion. The acreage used for alfalfa and oats has decreased. Corn is planted in some of the areas formerly planted to alfalfa and oats.

About 5,000 acres is used for sweet corn and peas. Special management is needed if these crops are grown. Generally, the soils are well drained and are nearly level or gently sloping. Sloping or steeper soils generally are not planted to sweet corn and peas because of the hazard of erosion.

On about 15 percent of the cropland, few or no limitations affect cropping. The soils in these areas are nearly level and are not significantly affected by the hazards of erosion and runoff or by wetness. Their available water capacity is high enough for the major crops. An example is Port Byron soils.

About 25 percent of the cropland consists of deep, well drained, gently sloping soils that are subject to runoff and erosion. Minimum tillage increases the ability of these soils to absorb runoff. An example is Mt. Carroll soils.

About 10 percent of the cropland consists of wet soils, such as Garwin and Maxfield soils. A subsurface drainage system generally is needed to increase the depth to which roots can penetrate and to provide better access to all parts of a field. These soils are on head slopes or in drainageways and receive runoff from upslope areas. Because many of these soils are tilled by conventional methods and most are fall plowed, a graded grassed waterway generally is needed to divert excess water and prevent scouring.

About 7 percent of the cropland is on low lying flood plains. Many of the soils in these areas could be highly productive, but they are occasionally or frequently flooded. Many of the flood plains are on narrow bottom land that could be protected by upstream structures.

About 20 percent of the cropland consists of soils that have a limited available water capacity and are somewhat droughty. Many of these soils are subject to erosion and runoff. Minimum tillage and contour farming are needed to prevent excessive soil losses. The crops selected for planting should be those that mature during the period when rainfall is most frequent.

About 23 percent of the cropland consists of sloping to steep, deep or moderately deep, medium textured soils. The amount of soil lost through erosion generally is high, especially in areas where conventional tillage is used. A system of minimum tillage or no-tillage in which crop residue is left on the surface almost all the time is needed. Conventional tillage methods, especially fall plowing, are not suitable because they can result in excessive soil losses. In many areas small dams, diversions, or terraces are needed to control runoff and erosion.

About 50,000 acres in the county is permanent pasture. Much of the acreage is not cultivated because the soils are too steep, are flooded too frequently, or are too wet. Many of the pastures are unmanaged or are grazed

during the generally short periods when forage plants, such as short, cool season grasses, are suitable for grazing. Many can be improved by introducing legumes, such as alfalfa, or by establishing high quality grasses, such as Garrison creeping foxtail, in wet areas that are dominated by low quality forage species. In many sloping areas old sod can be improved by seeding legumes.

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 4. 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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Agricultural Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

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 landforms 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 too cold or too 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, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 5. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Woodland management and productivity

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

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 some 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 equipment; *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 that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are 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. Important 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 suitable for commercial wood production and that are suited to the soils.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species 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 depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities. Table 11 shows the kind of limitations for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

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 are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have founda-

tion loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Lawns and landscaping require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over bedrock or hardpan to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of

compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of

moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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, soybeans, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties 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, bromegrass, clover, alfalfa, and Kentucky bluegrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties 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 the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, buffaloberry, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants 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, exclusive of submerged or floating aquatics. They produce food or

cover for wildlife that use wetland as habitat. Major soil properties 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, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. 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 absorb 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 earth-moving operations.

Moist bulk density is the weight of soil (oven dry) 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 is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be

required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing 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, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing 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, but crops can be grown if measures to control soil blowing 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, and 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, and crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In Table 15, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons

that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, matrix colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Arenzville series

The Arenzville series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. The upper part of this alluvium is of recent origin. A buried soil is below the alluvium. Slopes range from 0 to 2 percent.

Arenzville soils are similar to Chaseburg and Radford soils and are commonly adjacent to the sloping Lindstrom soils. They lack the thick layer of recent sediments characteristic of Chaseburg soils. They are not so wet as Radford soils. They are less sloping than Lindstrom soils, which lack stratified material.

Typical pedon of Arenzville silt loam, 1,300 feet west and 360 feet south of the northeast corner of sec. 12, T. 107 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; neutral; abrupt wavy boundary.

C—8 to 31 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common thin grayish brown (10YR 5/2) strata; moderate thin

platy structure; very friable; many very fine to medium tubular pores; neutral; abrupt wavy boundary.

Ab—31 to 35 inches; black (10YR 2/1) silt loam; moderate fine granular structure; friable; many very fine to medium tubular pores; neutral; clear wavy boundary.

B21b—35 to 45 inches; dark brown (10YR 4/3) silt loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate very fine subangular blocky structure; friable; many very fine to medium tubular pores; few thin clay films in pores; neutral; clear wavy boundary.

B22b—45 to 60 inches; yellowish brown (10YR 5/4) silt loam; dark brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; many very fine and fine pores; common thin clay films on faces of peds; neutral.

The upper part of the profile has value of 2 or 3 and chroma of 1 or 2. It typically has few to many, thin, lighter colored strata.

Depth to the Ab horizon ranges from 20 to 40 inches. This horizon has chroma of 1 or 2. In some pedons it is light silty clay loam. The B2b horizon has value of 4 or 5 and chroma of 2 to 6. It is silt loam or light silty clay loam.

Atkinson series

The Atkinson series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a loamy mantle of glacial till and in the underlying residuum of bedrock. They are dominantly on the summits of hills on dissected terrain. Slopes are 0 to 6 percent.

Atkinson soils are similar to and near Rockton soils and are similar to Waucoma soils. Rockton soils are higher on the landscape than Atkinson soils and are shallower to limestone. Waucoma soils are on a terrain similar to that of Atkinson soils. They lack a mollic epipedon.

Typical pedon of Atkinson loam, 0 to 1 percent slopes, 220 feet west and 460 feet north of the southeast corner of NE1/4 sec. 6, T. 105 N., R. 12 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; neutral; abrupt wavy boundary.

A3—8 to 13 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine and fine tubular pores; about 2 percent coarse fragments; medium acid; abrupt wavy boundary.

B21—13 to 18 inches; dark brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; common very dark brown (10YR 2/2) worm casts or root channels; weak very fine subangular blocky structure; friable; many very fine to medium tubular pores; about 2 percent coarse fragments; medium acid; clear wavy boundary.

B22t—18 to 24 inches; yellowish brown (10YR 5/4) loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium subangular blocky structure; friable; common very fine to medium tubular pores; about 8 percent coarse fragments; few thin clay films on faces of peds; medium acid; clear wavy boundary.

B23t—24 to 34 inches; yellowish brown (10YR 5/4) loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate fine prismatic structure parting to moderate very fine subangular blocky; friable; common very fine to medium continuous tubular pores; few thin clay films on faces of peds; about 8 percent coarse fragments; medium acid; clear wavy boundary.

B24t—34 to 41 inches; yellowish brown (10YR 5/4) clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine and fine continuous tubular pores; few thin clay films on faces of peds; about 4 percent coarse fragments; medium acid; clear wavy boundary.

R—41 inches; fractured limestone.

The thickness of the solum, or the depth to limestone bedrock, ranges from 40 to 55 inches. The A horizon is 10 to 17 inches thick. It typically is loam but in some pedons is silt loam. It is medium acid to neutral. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam. Some pedons have a IIB horizon.

Backbone series

The Backbone series consists of moderately deep, well drained, moderately rapidly permeable soils on uplands controlled by limestone bedrock. These soils formed in a thin mantle of glacial drift sediments and in the underlying limestone residuum. Slopes range from 1 to 6 percent.

Backbone soils are near Rockton soils and are similar to Whalan soils. Rockton soils have a mollic epipedon. Their position on the landscape is similar to that of Backbone soils. Whalan soils are also on similar terrain. They contain more silt and clay in the solum.

Typical pedon of Backbone sandy loam, 1 to 6 percent slopes, 400 feet east and 1,340 feet north of the southwest corner of SW1/4 sec. 18, T. 106 N., R. 12 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) light sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; about 4 percent gravel; neutral; abrupt wavy boundary.

A2—7 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; many very dark grayish brown (10YR 3/2) and grayish brown

(10YR 5/2) worm casts and root channels; weak fine subangular blocky structure; very friable; many very fine and medium tubular pores; about 4 percent gravel; neutral; abrupt wavy boundary.

B21—9 to 14 inches; dark brown (10YR 4/3) sandy loam; dark brown (10YR 3/3) coatings on faces of peds; few very dark grayish brown (10YR 3/2) worm casts; weak medium subangular blocky structure; friable; many very fine and medium tubular pores; common thin clay films; about 4 percent gravel; slightly acid; clear wavy boundary.

B22t—14 to 23 inches; yellowish brown (10YR 5/4) heavy sandy loam; few thin strata of loamy sand; moderate medium subangular blocky structure; very friable; many very fine and fine tubular pores; common thin clay films; about 4 percent gravel; slightly acid; abrupt wavy boundary.

IIB23t—23 to 28 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; friable; about 4 percent gravel; many medium pores; medium acid; abrupt wavy boundary.

R—28 inches; fractured limestone; clay fillings weathered along broken joints.

The thickness of the solum, or the depth to bedrock, ranges from 20 to 40 inches. The content of coarse fragments, mostly gravel, ranges from 1 to 8 percent. The solum is neutral to strongly acid. The B horizon is slightly acid to strongly acid. It has value of 4 or 5 and chroma of 3 or 4.

Becker series

Becker series consists of deep, moderately well drained, moderately rapidly permeable soils on high lying flood plains. These soils formed in postglacial alluvial sediments occurring as a coarse loamy mantle and the underlying sandy material. Slopes are 2 percent or less.

Becker soils are adjacent to Kalmarville, Spillville, and Zumbro soils. Kalmarville soils are on the lower lying flood plains and are poorly drained. Spillville and Zumbro soils and the Becker soils are in similar positions on the landscape. Spillville soils have a thicker solum than Becker soils and contain more clay. The well drained Zumbro soils contain more sand.

Typical pedon of Becker loam, 2,440 feet south and 1,020 feet east of the northwest corner of sec. 1, T. 105 N., R. 15 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; about 2 percent gravel; slightly acid; abrupt wavy boundary.

A12—9 to 16 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; very friable; about 2 percent gravel; medium acid; clear wavy boundary.

A31—16 to 20 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) continuous coatings; moderate fine subangular blocky structure; very friable; about 5 percent gravel; medium acid; abrupt wavy boundary.

A32—20 to 30 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; common very dark brown (10YR 2/2) coatings; weak medium subangular blocky structure; very friable; about 10 percent gravel; medium acid; clear wavy boundary.

IIB2—30 to 36 inches; dark brown (10YR 4/3) gravelly loamy coarse sand; common very dark brown (10YR 2/2) mixings; single grained; loose; about 20 percent gravel; slightly acid; abrupt wavy boundary.

IIC—36 to 60 inches; grayish brown (10YR 5/2) coarse sand; single grained; loose; about 15 percent gravel; mildly alkaline.

The solum is 24 to 48 inches thick. The mollic epipedon is 24 to 40 inches thick. The coarse-loamy mantle is 25 to 40 inches thick. The depth to free carbonates is 30 to 70 inches. The content of coarse fragments is as much as 10 percent in the coarse-loamy mantle and ranges from 0 to 25 percent in the sandy material below.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is medium acid to neutral. It is dominantly loam or sandy loam, but the range includes fine sandy loam. The IIB horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3. It has faint or distinct, high or low chroma mottles in some pedons. It is gravelly loamy coarse sand, loamy coarse sand, loamy sand, or loamy fine sand. It is slightly acid to mildly alkaline. The IIC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. It is coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand and is neutral or mildly alkaline.

Bellechester series

The Bellechester series consists of moderately deep, excessively drained, rapidly permeable soils on south- to west-facing foot slopes. These soils formed in sandy colluvium and in residuum of sandstone and limestone over soft sandstone bedrock. Slopes range from 25 to 45 percent.

Bellechester soils are adjacent to Brodale and Eyota soils. Brodale soils contain more limestone fragments than Bellechester soils and are in similar positions on the landscape. Eyota soils are on the lower foot slopes. They are loamy in the lower part of the solum.

Typical pedon of Bellechester loamy sand, 25 to 45 percent slopes, 880 feet south and 1,040 feet east of the northwest corner of SE1/4 sec. 31, T. 108 N., R. 13 W.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; common dark brown (10YR 4/3) mixings; weak fine subangu-

lar blocky structure; loose; slightly acid; clear wavy boundary.
A12—6 to 14 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; loose; neutral; clear wavy boundary.
A3—14 to 20 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; loose; about 10 percent coarse fragments, mostly channers; mildly alkaline; clear irregular boundary.
B2—20 to 25 inches; dark brown (10YR 3/3) loamy sand, dark brown (10YR 4/3) rubbed; weak fine subangular blocky structure; loose; mildly alkaline; slight effervescence; clear irregular boundary.
B3—25 to 34 inches; very pale brown (10YR 7/3) sand; common medium faint white (10YR 8/2) mottles; weak fine subangular blocky structure; loose; mildly alkaline; clear wavy boundary.
C1—34 to 43 inches; yellow (10YR 8/6) sand; many coarse distinct brownish yellow (10YR 6/6) mottles; weak fine subangular blocky structure; loose; mildly alkaline; clear irregular boundary.
Cr—43 inches; white (10YR 8/2) soft sandstone.

The thickness of the solum ranges from 30 to 50 inches. The depth to soft sandstone bedrock ranges from 40 to 70 inches. The content of coarse fragments is dominantly 0 to 20 percent but ranges to 35 percent in some pedons. Reaction is slightly acid to moderately alkaline above the bedrock.

The A horizon is 12 to 24 inches thick. It has value of 2 or 3 and chroma of 1 or 2. It is typically loamy sand but is loamy fine sand in some pedons. The B2 horizon has value of 3 to 6 and chroma of 1 to 8. The B horizon is sand, loamy sand, or fine sand. The C horizon is sand or fine sand. The sandstone bedrock generally is soft and is weakly cemented.

Brodale series

The Brodale series consists of deep, excessively drained, moderately permeable soils formed in a loamy mantle containing many fragments of limestone. These soils typically are on south- to west-facing slopes in stream valleys. Slopes range from 12 to 80 percent.

Brodale soils are near Bellechester, Marlean, and Sogn soils. Bellechester soils are on foot slopes. Their solum contains fewer coarse fragments than that of Brodale soils. Marlean soils are on north- to east-facing slopes. They lack the secondary accumulations of lime characteristic of Brodale soils. Sogn soils have a lithic contact of limestone bedrock within a depth of 20 inches.

Typical pedon of Brodale flaggy sandy loam, 40 to 80 percent slopes, 295 feet east and 66 feet south of the northwest corner of sec. 2, T. 108 N., R. 14 W.

A1—0 to 12 inches; black (10YR 2/1) flaggy sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; about 45 percent coarse fragments, mostly flagstones and some channers; 2- to 5-millimeter secondary lime accumulations on the undersides of large fragments; slight effervescence; mildly alkaline; clear wavy boundary.
B2—12 to 24 inches; dark brown (10YR 4/3) very flaggy sandy loam; weak fine granular structure; very friable; about 80 percent coarse fragments, mostly flagstones, channers, and cobbles; strong effervescence; moderately alkaline; clear irregular boundary.
C—24 to 45 inches; grayish brown (10YR 5/2) very flaggy sandy loam; massive; very friable; about 85 percent coarse fragments, about 60 percent of which are flagstones, boulders, channers, and cobblestones; moderately alkaline; strong effervescence; abrupt smooth boundary.
R—45 inches; hard limestone bedrock that has some fractures.

The solum ranges from 8 to 28 inches in thickness. The depth to bedrock ranges from 40 to more than 80 inches. Free or secondary carbonates are throughout the profile, and reaction is mildly alkaline or moderately alkaline throughout. The solum ranges from 40 to 85 percent coarse fragments, most of which are flagstones and channers. The fine earth fraction of the material above bedrock is loamy very fine sand, sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam.

The A1 horizon has value of 2 or 3 and chroma of 1 or 2. It is flaggy loam or flaggy sandy loam. The B horizon has value of 4 or 5 and chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 2 to 4.

Channahon series

The Channahon series consists of shallow, well drained, moderately permeable soils formed in a thin mantle of loamy sediments over limestone bedrock. These soils are on summits and the upper side slopes on dissected terrain. Slopes range from 1 to 12 percent.

Channahon soils are near Dorerton, Rockton, and Sogn soils. Dorerton soils have a loamy mantle that is deeper over limestone bedrock than that of Channahon soils. They lack a mollic epipedon. Rockton soils are deeper to lithic contact than Channahon soils. Their position on the landscape is similar to that of Channahon soils. Sogn soils lack an argillic horizon.

Typical pedon of Channahon loam, 1 to 6 percent slopes, 120 feet north and 1,180 feet west of the southeast corner of NE1/4 sec. 6, T. 105 N., R. 12 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; very friable; slightly acid; abrupt wavy boundary.
A3—8 to 12 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; very dark

gray (10YR 3/1) coatings on faces of peds; many black (10YR 2/1) tubular pores; moderate very fine subangular blocky structure parting to moderate very fine granular; friable; many very fine and fine open tubular pores; neutral; clear wavy boundary.

B2t—12 to 15 inches; dark brown (10YR 4/3) loam; many very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine subangular blocky structure parting to moderate fine granular; friable; slightly acid; common thin clay films; about 5 percent coarse fragments; abrupt wavy boundary.

R—15 inches; hard fractured limestone.

The thickness of solum, or the depth to limestone bedrock, is 12 to 20 inches. The solum is slightly acid to mildly alkaline. The mollic epipedon is 8 to 12 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It typically is loam but in some pedons is silt loam. The B2 horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam and has few to many clay films on faces of peds.

Chaseburg series

The Chaseburg series consists of deep, moderately well drained, moderately permeable soils formed dominantly in recent alluvial sediments. These soils are generally in upland drainageways that are frequently flooded. Slopes range from 0 to 3 percent.

The Chaseburg soils in Olmsted County are outside the range defined for the Chaseburg series; they have color value of mostly 3, and they could qualify as Mollic Udifluvents. This difference, however, does not significantly affect the use or behavior of the soils.

Chaseburg soils are similar to Arenzville soils and are adjacent to Mt. Carroll soils on side slopes. Arenzville soils are on botton land along small streams. They have a buried horizon within 40 inches of the surface. Mt. Carroll soils have not received recent sediments.

Typical pedon of Chaseburg silt loam, 1,115 feet south and 20 feet west of the northeast corner of NW1/4 sec. 1, T. 105 N., R. 12 W.

A1—0 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common thin dark grayish brown (10YR 4/2) strata, grayish brown (10YR 5/2) dry; moderate coarse platy structure parting to very fine granular; very friable; neutral; clear smooth boundary.

C1—15 to 36 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common thin light gray (10YR 7/1) and dark grayish brown (10YR 4/2) strata; moderate medium platy structure; very friable; many very fine and fine tubular pores; neutral; abrupt wavy boundary.

C2—36 to 51 inches; very dark gray (10YR 3/1) silt loam; moderate medium subangular blocky structure; very friable; many very fine to medium tubular pores; few sand coatings on faces of peds; neutral; clear wavy boundary.

Ab—51 to 55 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.

Bb—55 to 60 inches; dark yellowish brown (10YR 4/4) heavy silt loam; moderate medium subangular blocky structure; friable; few clay films on faces of peds; neutral.

The thickness of the recent sediments ranges from 35 to 60 inches. Color value typically is 3, but it ranges from 2 to 4. Texture typically is silt loam throughout, but a few thin strata of sandy loam are in some pedons. Reaction is slightly acid or neutral.

Coggon series

The Coggon series consists of deep, moderately well drained, moderately slowly permeable soils formed in a thin loamy mantle and in the underlying glacial till. These soils typically are on summits in the uplands. Slopes range from 2 to 6 percent.

Coggon soils are near Kasson, Racine, and Skyberg soils. The landscape position of Kasson and Racine soils is similar to that of Coggon soils. Kasson soils are mottled in the upper part of the profile, and Racine soils have a darker A1 horizon than Coggon soils. Skyberg soils are somewhat poorly drained.

Typical pedon of Coggon silt loam, 2 to 6 percent slopes, 1,390 feet south and 270 feet west of the northeast corner of NE1/4 sec. 30, T. 106 N., R. 14 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; very friable; slightly acid; abrupt wavy boundary.

A2—8 to 12 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; moderate thin platy structure; very friable; many very fine and fine and few medium tubular pores; continuous moderately thick clean very fine sand and coarse silt coatings on faces of peds; strongly acid; abrupt wavy boundary.

B1—12 to 18 inches; yellowish brown (10YR 5/4) loam; brown (10YR 5/3) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; many very fine and fine and few medium tubular pores; many moderately thick clean very fine sand and coarse silt coatings on faces of peds; strongly acid; abrupt wavy boundary.

IIB21t—18 to 26 inches; brown (10YR 5/3) clay loam; moderate fine subangular blocky structure; firm; common very fine, fine, and coarse tubular pores; about 16 percent coarse fragments, mostly in a stone line in the upper part; common moderately thick very fine and fine sand coatings on faces of peds; strongly acid; clear wavy boundary.

IIB22t—26 to 35 inches; brown (10YR 5/3) clay loam; common medium faint grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; firm; common fine tubular pores; few clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

IIB23t—35 to 55 inches; brown (10YR 5/3) clay loam; common medium faint grayish brown (10YR 5/2) mottles; moderate medium prismatic structure; firm; many moderately thick dark reddish brown (5YR 3/2) pore fillings of clay; common moderately thick clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

IIC—55 to 65 inches; brown (10YR 5/3) loam; many medium faint light brownish gray (10YR 6/2) mottles; massive; about 3 percent coarse fragments; fine threads of free carbonates; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 55 to 70 inches. The thickness of the loamy mantle ranges from 14 to 24 inches. In the underlying glacial till, the content of coarse fragments ranges from 2 to 10 percent.

The A horizon is typically silt loam but is loam in some pedons. It ranges from neutral to strongly acid. The Ap horizon has value of 3 or 4 and chroma of 1 or 2. The A1 horizon, which occurs in wooded areas, has value of 2. The A2 horizon has value of 4 to 6 and chroma of 2 or 3. It does not occur in some pedons. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or silt loam. The IIB horizon has value of 4 or 5 and chroma of 3 or 4. It is loam, clay loam, or sandy clay loam and generally has few to many low chroma mottles. Some pedons have common distinct or prominent high chroma mottles. The B and IIB horizons are medium acid or strongly acid. The IIC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is loam or light clay loam.

Dickinson series

The Dickinson series consists of deep, well drained and somewhat excessively drained, moderately rapidly permeable soils on stream terraces. These soils formed in outwash material that is loamy in the upper part and sandy in the lower part. Slopes range from 0 to 12 percent.

Dickinson soils are similar to Waukee soils and in places are adjacent to Plainfield soils. Waukee soils contain less sand in the solum than Dickinson soils. They are in the same position on the landscape as those soils. Plainfield soils are on benches along streams and on foot slopes. They are sandy throughout.

Typical pedon of Dickinson sandy loam, 0 to 1 percent slopes, 200 feet south and 510 feet east of the northwest corner of NE1/4 sec. 21, T. 108 N., R. 14 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; about 4 percent gravel; neutral; abrupt wavy boundary.

A3—8 to 15 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; very friable; many very fine to medium pores; about 4 percent fine gravel; neutral; clear wavy boundary.

B21—15 to 20 inches; dark brown (10YR 4/3) sandy loam; dark brown (10YR 3/3) coatings on faces of peds; weak fine subangular blocky structure; very friable; many very fine to medium tubular pores; few fine clay films; about 4 percent fine gravel; medium acid; clear wavy boundary.

B22—20 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; about 4 percent gravel; many very fine to medium tubular pores; about 4 percent fine gravel; medium acid; clear wavy boundary.

B3—28 to 38 inches; yellowish brown (10YR 5/6) sand; single grained; loose; medium acid; clear wavy boundary.

C—38 to 60 inches; yellowish brown (10YR 5/4) sand; common thin bands of loamy sand; single grained; loose; about 10 percent fine gravel; mildly alkaline.

The thickness of the solum ranges from 24 to 40 inches. Depth to the coarser textured material ranges from 24 to 50 inches.

The A horizon ranges from 10 to 20 inches in thickness. It is typically sandy loam but is loam in some pedons. It is neutral or slightly acid. It has chroma and value of 2 or 3. The B horizon has value of 4 or 5 and chroma of 3 to 6. The B2 horizon is loam or sandy loam and is slightly acid or medium acid. The B3 and C horizons are loamy sand or sand.

Dorerton series

The Dorerton series consists of deep, well drained and somewhat excessively drained soils that are moderately permeable. These soils formed in a loamy mantle and in the underlying skeletal material. They are on the upper side slopes and shoulders on deeply dissected terrain. Slopes range from 12 to 40 percent.

Dorerton soils are similar to Brodale, Frontenac, and Marlean soils. They are adjacent to those soils. Brodale and Marlean soils have a mollic epipedon. Frontenac soils are typically on the lower lying foot slopes. They are deeper to skeletal material than Dorerton soils.

Typical pedon of Dorerton loam, 25 to 40 percent slopes, 800 feet north and 1,700 feet west of the southeast corner of sec. 11, T. 108 N., R. 14 W.

A1—0 to 3 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; moderate fine granu-

lar structure; very friable; many roots; slightly acid; abrupt smooth boundary.

A21—3 to 5 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; many very dark grayish brown (10YR 3/2) worm casts; many very fine to medium tubular pores; common roots; medium acid; abrupt wavy boundary.

A22—5 to 10 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; weak medium platy structure; very friable; many very fine to large tubular pores; common roots; strongly acid; clear irregular boundary.

B1—10 to 15 inches; brown (10YR 5/3) loam; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; few roots; many thin coatings of clean silt and sand particles on faces of peds; strongly acid; clear wavy boundary.

B21t—15 to 18 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; common medium tubular pores; many thin dark brown (7.5YR 3/2) clay films on faces of peds; slightly acid; abrupt wavy boundary.

IIB22t—18 to 30 inches; dark brown (7.5YR 4/4) very channery clay loam; strong medium subangular blocky structure; firm; about 50 percent limestone fragments ranging from pebbles to flagstones in size; many thick dark brown (7.5YR 3/2) clay films on faces of peds; slightly acid; clear irregular boundary.

IIC—30 to 60 inches; very pale brown (10YR 7/3) very flaggy loamy sand; single grained; loose; about 75 percent limestone fragments ranging from pebbles to flagstones in size; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 45 inches. The depth to limestone bedrock ranges from 45 to 70 inches.

The A1 horizon has value of 2 or 3 and chroma of 1 or 2. It is medium acid to neutral. The A2 horizon has value of 3 to 5 and chroma of 2 or 3. It is strongly acid to slightly acid. The B and IIB horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The IIB horizon has a fine earth fraction of loam or clay loam that is 20 to 35 percent clay. The IIC horizon has value of 6 or 7 and chroma of 3 or 4. It has a fine earth fraction of sand, fine sand, loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

Dowagiac series

The Dowagiac series consists of deep, well drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils formed in a loamy mantle of glacial sediments and in the underlying sandy sediments. They are on terraces. Slopes range from 0 to 12 percent.

Dowagiac soils are similar to Kegonsa soils and are adjacent to Kegonsa and Racine soils. Kegonsa soils are in outwash areas along streams. They contain more silt in the upper part of the solum than Dowagiac soils. Racine soils formed in glacial till. They are higher on the landscape than Dowagiac soils.

Typical pedon of Dowagiac silt loam, 2 to 6 percent slopes, 1,200 feet west and 1,220 feet north of the southeast corner of NW1/4 sec. 1, T. 104 N., R. 15 W.

A1—0 to 4 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable; slightly acid; abrupt wavy boundary.

A2—4 to 8 inches; dark brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; dark brown (10YR 3/3) coatings on faces of peds; moderate very fine platy structure; neutral; abrupt wavy boundary.

B21—8 to 15 inches; dark brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; many very fine to medium tubular pores; neutral; abrupt wavy boundary.

B22t—15 to 21 inches; dark brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; about 11 percent fine gravel; common thin clay films; neutral; abrupt wavy boundary.

IIB23t—21 to 35 inches; dark brown (7.5YR 3/2) gravelly coarse sandy loam; moderate fine subangular blocky structure; friable; about 25 percent gravel and 25 percent cobblestones; many moderately thick clay bridgings on sand grains; slightly acid; clear wavy boundary.

IIB3—35 to 43 inches; dark brown (7.5YR 3/2) gravelly loamy coarse sand; weak coarse subangular blocky structure; very friable; about 50 percent gravel and a few cobblestones; many clay bridgings on sand grains; slightly acid; clear wavy boundary.

IIC—43 to 60 inches; light yellowish brown (10YR 6/4) coarse sand; single grained; loose; about 10 percent pebbles; mildly alkaline.

The thickness of the solum ranges from 36 to 50 inches. The depth to free carbonates ranges from 50 to 70 inches. The depth to the sandy material is 20 to 30 inches. The lower part of solum ranges from 15 to 50 percent gravel and has some cobblestones.

The A1 or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 3 to 4 and chroma of 2 or 3. The A horizon typically is silt loam but in some pedons is loam or sandy loam. It is medium acid to neutral. The B horizon has value of 4 or 5 and chroma of 3 or 4. The IIB horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. The B and IIB horizons range from neutral to strongly acid. The IIC horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 2 to 6. It is typically coarse sand but is gravelly coarse sand or loamy coarse sand in some pedons.

Elbaville series

The Elbaville series consists of deep, well drained soils that are moderately slowly permeable in the solum and moderately rapidly permeable in the underlying material. These soils formed in a mantle of loess and in loamy-skeletal material derived from fragmented limestone. They are on the sides of ravines and narrow ridges. Slopes range from 12 to 30 percent.

Elbaville soils are similar to Dorerton and Frankville soils. They are adjacent to Mt. Carroll soils. Dorerton soils formed in a mantle that is more shallow over limestone residuum than that in which Elbaville soils formed. Their position on the landscape is similar to that of Elbaville soils. Frankville soils are upslope from Elbaville soils. Their lithic contact is within 40 inches of the surface. Mt. Carroll soils also are upslope from Elbaville soils. They formed in thick deposits of loess.

Typical pedon of Elbaville silt loam, 18 to 30 percent slopes, 75 feet south and 800 feet east of the northwest corner of sec. 8, T. 107 N., R. 15 W.

O—0 to 1 inch; partly decomposed and decomposed forest litter.

A1—0 to 4 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; neutral; abrupt wavy boundary.

A21—4 to 7 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure; very friable; many black (10YR 2/1) worm casts; neutral; clear irregular boundary.

A22—7 to 10 inches; grayish brown (10YR 5/2) silt, light gray (10YR 7/2) dry; weak fine subangular blocky structure; very friable; neutral; clear irregular boundary.

B&A—10 to 16 inches; brown (10YR 5/3) silt loam (Bt); many interfingerings of grayish brown (10YR 5/2) silt (A2), light gray (10YR 7/2) dry; moderate fine subangular blocky structure; very friable; many very fine to medium tubular pores; neutral; clear irregular boundary.

B21t—16 to 20 inches; brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; friable; few thin clay films on faces of peds; many very fine to medium tubular pores; neutral; abrupt wavy boundary.

IIB22t—20 to 25 inches; dark brown (7.5YR 4/2) silty clay; strong very fine angular blocky structure; firm; few very fine and fine tubular pores; many thin dark brown (7.5YR 3/2) clay films on faces of peds; neutral; abrupt wavy boundary.

IIIB23t—25 to 36 inches; dark brown (10YR 4/3) very flaggy silty clay loam; strong very fine angular blocky structure; friable; many thin clay films on faces of peds; about 50 percent coarse fragments, mostly flagstones and some channers; mildly alkaline; gradual wavy boundary.

IIIC—36 to 60 inches; yellowish brown (10YR 5/4) very flaggy sandy loam; massive; friable; about 70 percent coarse fragments, mostly flagstones and some channers; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 60 inches. The depth to free carbonates ranges from 40 to 70 inches. The thickness of the loess mantle ranges from 15 to 30 inches. The upper part of the solum typically contains no coarse fragments. The IIIB and IIIC horizons range from 35 to 80 percent coarse fragments. Reaction is neutral to medium acid in the upper part of these soils and mildly alkaline or moderately alkaline in the lower part.

The A1 horizon has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B21 horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam or silty clay loam. The IIB horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay or heavy silty clay loam. The C horizon has value of 4 to 7 and chroma of 3 or 4. It has a fine earth fraction of sand, fine sand, loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

Eleva series

The Eleva series consists of moderately deep, well drained soils that are moderately rapidly permeable. These soils formed in eolian or outwash sediments over sandstone. They are on small knolls on bedrock-controlled benches along the major streams. Slopes range from 2 to 12 percent.

Eleva soils are near Waukee soils and are somewhat similar to Lamont soils. Waukee soils have a mollic epipedon. They are on the level parts of benches. Lamont soils are not underlain by sandstone bedrock.

Typical pedon of Eleva sandy loam, 2 to 6 percent slopes, 1,160 feet east and 80 feet south of the northwest corner of SW1/4 sec. 19, T. 108 N., R. 14 W.

A1—0 to 4 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; neutral; clear wavy boundary.

A2—4 to 9 inches; dark brown (10YR 4/3) sandy loam, grayish brown (10YR 5/2) dry; few very dark brown (10YR 2/2) and dark brown (10YR 3/3) masses; weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

B21t—9 to 16 inches; dark yellowish brown (10YR 4/4) fine sandy loam; dark brown (10YR 4/3) coatings on faces of peds; weak fine subangular blocky structure; very friable; slightly acid; clear wavy boundary.

B22t—16 to 21 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure; very friable; pebble and stone line at 21 inches; medium acid; clear wavy boundary.

B3—21 to 32 inches; brownish yellow (10YR 6/6) fine sand; single grained; loose; strongly acid; clear wavy boundary.
Cr—32 to 50 inches; yellow (2.5Y 8/6) weakly cemented sandstone.
R—50 inches; pale yellow (2.5Y 8/4) indurated sandstone.

The thickness of the solum, or the depth to weakly cemented sandstone, ranges from 20 to 40 inches. The depth to hard, cemented sandstone ranges from 40 to 60 inches.

The A horizon has value of 2 to 4 and chroma of 2 or 3. It ranges from neutral to strongly acid. The B2 horizon has chroma of 3 to 5 and value of 4. It is fine sandy loam, sandy loam, or loam. The Cr horizon has hue of 2.5Y, 10YR, or 7.5YR; value of 6 to 8; and chroma of 4 to 8.

Eyota series

The Eyota series consists of deep, well drained, moderately permeable soils on foot slopes. These soils formed in a thin mantle of coarse textured and moderately coarse textured colluvium and in the underlying sediments, dominantly loess. Slopes range from 6 to 25 percent.

Eyota soils are near Bellechester, Lindstrom, and Port Byron soils. Bellechester soils are typically upslope from Eyota soils. They are sandy throughout. Lindstrom and Port Byron soils formed entirely in loess. The position of Lindstrom soils on the landscape is similar to that of Eyota soils. Port Byron soils are in the higher upland positions.

Typical pedon of Eyota loamy sand, 12 to 25 percent slopes, 1,320 feet west and 1,300 feet south of the northeast corner of sec. 11, T. 108 N., R. 13 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; neutral; clear wavy boundary.
A3—10 to 24 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many very fine to medium tubular pores; about 2 percent pebbles; slightly acid; clear wavy boundary.
IIB1—24 to 27 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine subangular blocky structure; friable; many very fine to medium pores; slightly acid; clear wavy boundary.
IIB21—27 to 39 inches; dark brown (10YR 3/3) silt loam; moderate medium subangular blocky structure; friable; many fine to medium tubular pores; slightly acid; clear wavy boundary.
IIB3—39 to 50 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; slightly acid; abrupt wavy boundary.
IIC—50 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; very friable; neutral.

The thickness of the solum ranges from 40 to 70 inches and that of the upper mantle from 6 to 30 inches. The thickness of the mollic epipedon is dominantly 24 to 36 inches but ranges from 24 to 50 inches. The content of coarse fragments ranges from 0 to 10 percent in the solum. Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is loamy sand and fine sandy loam, but the range includes loamy fine sand and sandy loam. The IIB horizon has value of 3 to 5 and chroma of 2 to 4. It is loam or silt loam. Some pedons have a IIIB horizon. The IIC horizon has value of 5 or 6 and chroma of 4 to 6. It is mottled in some pedons. It is fine sandy loam, loam, or silt loam. A IIIC horizon of soft sandstone is as shallow as 50 inches in a few pedons.

Floyd series

The Floyd series consists of deep, somewhat poorly drained soils that are moderately permeable. These soils formed in a stratified loamy mantle and in the underlying loamy glacial till. They are on head slopes above drainageways on uplands. Slopes range from 1 to 4 percent.

The Floyd soils in Olmsted County are more acid in the solum than is defined as the range for the Floyd series. This difference, however, does not alter the use or behavior of the soils.

Floyd soils are similar to Readlyn soils and are adjacent to Maxfield, Kenyon, and Readlyn soils. Kenyon soils are on summits and are moderately well drained. Maxfield soils are in drainageways and are poorly drained. Readlyn soils are more shallow over glacial till than Floyd soils.

Typical pedon of Floyd silt loam, 1 to 4 percent slopes, 400 feet east and 500 feet north of the southwest corner of NE1/4 sec. 20, T. 105 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; medium acid; abrupt wavy boundary.
A12—8 to 14 inches; black (10YR 2/1) clay loam high in content of silt, dark gray (10YR 4/1) dry; moderate very fine and fine granular structure; friable; many very fine to medium tubular pores; strongly acid; clear wavy boundary.
A13—14 to 18 inches; very dark brown (10YR 2/2) silt loam high in content of sand, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many very fine to medium tubular pores; strongly acid; clear wavy boundary.
A3—18 to 22 inches; very dark grayish brown (10YR 3/2) loam high in content of silt, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; many very fine to medium tubular pores; medium acid; clear wavy boundary.

B22—22 to 26 inches; dark grayish brown (10YR 4/2) loam; common fine distinct yellowish brown (10YR 5/6) mottles; common very dark brown (10YR 2/2) tubular masses; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; medium acid; clear wavy boundary.

IIB23—26 to 35 inches; olive brown (2.5Y 4/4) loam; common medium faint grayish brown (2.5Y 5/2) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; friable; thin stone line in the upper part; 5 percent coarse fragments; medium acid; clear wavy boundary.

IIB24—35 to 50 inches; yellowish brown (10YR 5/4) loam; common fine faint grayish brown (10YR 5/2) and many medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; about 6 percent coarse fragments; slightly acid; clear wavy boundary.

IIC—50 to 65 inches; yellowish brown (10YR 5/4) loam; common medium faint grayish brown (10YR 5/2) and many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 9 percent coarse fragments; mildly alkaline; slight effervescence.

The thickness of solum ranges from 40 to 60 inches and that of the mollic epipedon from 15 to 24 inches. The depth to free carbonates ranges from 45 to 75 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is strongly acid to neutral. It is dominantly silt loam, but the range includes loam, clay loam, and silty clay loam. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. In some pedons it has mottles with chroma of 2 or less. It is loam, silt loam, or clay loam and is medium acid or slightly acid. The IIB horizon is loam or light clay loam. It has colors similar to those of the B horizon. It is medium acid or slightly acid. The IIC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It has few to many low or high chroma mottles.

Frankville series

The Frankville series consists of moderately deep, well drained soils that are moderately permeable. These soils formed in a mantle of loess and in a thin layer of limestone residuum. They are on summits and the upper side slopes on dissected uplands. Slopes range from 1 to 12 percent.

Frankville soils are near Elbaville, Marlean, and Mt. Carroll soils. Elbaville soils are steeper than Frankville soils. They formed in loess and in the underlying fragmented material derived from limestone. Marlean soils are very steep. They formed in loess and in the underlying loamy-skeletal material. Mt. Carroll soils are higher on the landscape than Frankville soils. They formed entirely in loess.

Typical pedon of Frankville silt loam, 1 to 6 percent slopes, 1,120 feet north and 800 feet east of the southwest corner of SW1/4 sec. 8, T. 107 N., R. 12 W.

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

A2—7 to 12 inches; dark brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; common very dark grayish brown (10YR 3/2) masses; moderate fine subangular blocky structure; very friable; medium acid; clear wavy boundary.

B1—12 to 16 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; friable; many thin clean coatings of silt and very fine sand on faces of peds; many very fine and fine tubular pores; slightly acid; clear wavy boundary.

B21t—16 to 24 inches; dark yellowish brown (10YR 4/4) silty clay loam; dark brown (10YR 4/3) coatings; moderate medium subangular blocky structure; friable; many very fine and medium tubular pores; many thin coatings of clean silt and very fine sand on faces of peds; common thin clay films; medium acid; clear wavy boundary.

B22t—24 to 32 inches; dark yellowish brown (10YR 4/4) silt loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; common thin coatings of silt and very fine sand on faces of peds; many thin clay films on faces of peds; medium acid; clear wavy boundary.

IIB23t—32 to 37 inches; yellowish brown (10YR 5/6) silty clay; strong medium angular blocky structure; firm; many very thin clay films; slightly acid; abrupt smooth boundary.

R—37 inches; hard somewhat fractured limestone.

The thickness of solum, or the depth to bedrock, ranges from 20 to 40 inches. The A1 or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. It is silt loam or silt. The B2 horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam or silty clay loam. Most faces of peds have common or many, thin to thick, clean silt or very fine sand coatings. The IIB horizon ranges from 1 inch to 6 inches in thickness.

Frontenac series

The Frontenac series consists of deep, well drained, moderately permeable soils on foot slopes in valleys. These soils formed in a loamy mantle and in the underlying skeletal material, which contains fragmented limestone. Slopes range from 15 to 35 percent.

Frontenac soils are near Brodale, Dorerton, and Marlean soils. Brodale and Marlean soils have skeletal material in the upper part of the solum. Dorerton soils are

higher on the landscape than Frontenac soils. They lack a mollic epipedon.

Typical pedon of Frontenac loam, 15 to 35 percent slopes, 620 feet south and 200 feet east of the northwest corner of sec. 23, T. 106 N., R. 15 W.

A1—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; very friable; slightly acid; clear wavy boundary.

A3—10 to 14 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; few black (10YR 2/1) worm casts; moderate fine granular structure; friable; many very fine to medium tubular pores; slightly acid; clear wavy boundary.

B21t—14 to 20 inches; dark brown (10YR 4/3) heavy loam; black (10YR 2/1) worm casts; moderate medium subangular blocky structure; few thin clay films; friable; many very fine to medium tubular pores; slightly acid; clear wavy boundary.

B22t—20 to 27 inches; dark brown (10YR 4/3) heavy loam; moderate medium subangular blocky structure; common thin clay films; friable; many very fine to medium tubular pores; neutral; about 15 percent channers; clear wavy boundary.

IIC—27 to 60 inches; yellowish brown (10YR 5/6) channery loam; massive; very friable; about 50 percent channers and 20 percent flagstones; mildly alkaline.

The thickness of the solum, or the depth to the IIC horizon, ranges from 20 to 40 inches. The depth to carbonates in the fine earth fraction ranges from 20 to 60 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is loam but is silt loam in some pedons. It is slightly acid or neutral. The B horizon is loam or silt loam and is slightly acid or neutral. It ranges from 0 to 15 percent coarse fragments, mostly limestone. The IIC horizon has value of 4 to 8 and chroma of 3 to 6. It ranges from 35 to 70 percent channers and flagstones.

Garwin series

The Garwin series consists of deep, poorly drained soils that are moderately permeable. These soils formed in loess in drainageways and on head slopes in the uplands. Slopes range from 0 to 3 percent.

Garwin soils are similar to Maxfield soils and are commonly adjacent to Joy, Mt. Carroll, and Port Byron soils. Maxfield soils formed in loess and in the underlying loamy glacial till. Joy, Mt. Carroll, and Port Byron soils are better drained than Garwin soils. Also, they are higher on the landscape or are more sloping.

Typical pedon of Garwin silty clay loam, 1,380 feet east and 900 feet north of the southwest corner of sec. 13, T. 107 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; neutral; abrupt wavy boundary.

A12—8 to 13 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; moderate fine angular blocky structure parting to moderate fine granular; friable; common very fine tubular pores; neutral; clear wavy boundary.

B21g—13 to 18 inches; dark grayish brown (2.5Y 4/2) silty clay loam; very dark gray (10YR 3/1) coatings on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure parting to moderate very fine granular; friable; many fine tubular pores; neutral; clear wavy boundary.

B22g—18 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam; dark gray (10YR 4/1) coatings on faces of peds; many medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; many fine tubular pores; few thin clay films on faces of peds; neutral; clear wavy boundary.

B23g—26 to 33 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct light olive brown (2.5Y 5/6) mottles; common dark gray (10YR 4/1) coatings on faces of peds; moderate medium subangular blocky structure; slightly sticky; few thin clay films on faces of peds; neutral; clear wavy boundary.

B3g—33 to 40 inches; olive gray (5Y 5/2) silt loam; few dark gray (5Y 4/1) coatings on faces of peds; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; slightly sticky; neutral; clear wavy boundary.

Cg—40 to 65 inches; olive gray (5Y 5/2) silt loam; many medium prominent yellowish brown (10YR 5/6) and many medium faint gray (5Y 5/1) mottles; weak medium subangular blocky structure; slightly sticky; neutral.

The solum ranges from 40 to 55 inches in thickness. It is neutral or slightly acid. The depth to free carbonates ranges from 60 to 72 inches.

The A horizon is 13 to 24 inches thick. The B horizon has hue of 2.5 or 5Y, value of 4 or 5, and chroma of 1 or 2. It has common or many faint to prominent mottles. The C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. It has common or many distinct to faint mottles.

Haverhill series

The Haverhill series consists of moderately deep, very poorly drained soils that are slowly permeable. These soils formed in shaly material that contains limestone fragments. They are on foot slopes and toe slopes on dissected uplands. Slopes range from 1 to 8 percent.

Haverhill soils are near Brodale, Schapville, and Shullsburg soils. Brodale soils are generally very steep and are excessively drained. Schapville soils are moderately well drained and are on side slopes. Shullsburg soils are somewhat poorly drained.

Typical pedon of Haverhill clay, 1 to 8 percent slopes, 640 feet east and 760 feet south of the center of SE1/4 sec. 27, T. 106 N., R. 13 W.

A1—0 to 8 inches; black (N 2/0) clay, very dark gray (10YR 3/1) dry; moderate fine granular and weak fine subangular blocky structure; friable; slight effervescence; mildly alkaline; clear irregular boundary.
A3—8 to 13 inches; very dark gray (5Y 3/1) clay, dark gray (5Y 4/1) dry; black (N 2/0) coatings on faces of peds; strong fine granular structure; firm; slight effervescence; mildly alkaline; clear irregular boundary.
B21g—13 to 15 inches; very dark gray (5Y 3/1) clay; many medium faint dark grayish brown (10YR 4/2) and few fine distinct yellowish brown (10YR 5/6) mottles; strong fine subangular blocky structure; sticky; about 5 percent limestone fragments; slight effervescence; mildly alkaline; abrupt wavy boundary.
B22g—15 to 21 inches; dark olive gray (5Y 3/2) channery clay; very dark gray (5Y 3/1) coatings on faces of peds; many fine and medium prominent light gray (5Y 6/1) mottles; moderate coarse subangular blocky structure; slightly sticky; about 20 percent limestone pebbles and fragments; strong effervescence; mildly alkaline; abrupt wavy boundary.
B3g—21 to 32 inches; greenish gray (5G 6/1) clay; many medium prominent light olive brown (2.5Y 5/4) mottles; massive; firm; about 15 percent limestone pebbles and fragments; mildly alkaline; strong effervescence; gradual irregular boundary.
Cr—32 inches; greenish gray (5G 6/1) shale.

The thickness of solum ranges from 20 to 35 inches. The content of coarse fragments ranges from 0 to 10 percent in the A horizon and from 5 to 35 percent in the B horizon. The fragments are gravelly, channery, or flaggy limestone.

The A horizon either has hue of 10YR to 5Y, value of 2 or 3, and chroma of 1 or is neutral in hue and has value of 2 or 3 and chroma of 0. It typically is clay but in some pedons is silty clay loam, silty clay, or mucky silty clay loam. The B horizon has hue of 5Y to 5G, value of 3 to 6, and chroma of 1 or 2. It has few to many mottles. It typically is clay or channery clay, but it is silty clay in some pedons and has coarser textured subhorizons in a few pedons. The Cr horizon either has hue of 5Y to 5G, value of 5 or 6, and chroma of 1 or is neutral in hue and has value of 5 or 6 and chroma of 0.

Hoopeston series

The Hoopeston series consists of deep, somewhat poorly drained soils that are moderately rapidly permeable. These soils formed in a loamy mantle of outwash sediments and in the underlying sandy outwash sediments. They are on outwash plains and on uplands that are covered with outwash deposits. Slopes range from 0 to 4 percent.

Hoopeston soils are similar to Dickinson soils and are adjacent to Floyd and Maxfield soils. Dickinson soils are well drained and somewhat excessively drained and are generally on outwash terraces. Floyd and Maxfield soils formed in glacial till. Also, Maxfield soils are poorly drained.

Typical pedon of Hoopeston sandy loam, 120 feet west and 480 feet south of the northeast corner of sec. 34, T. 106 N., R. 12 W.

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; slightly acid; abrupt wavy boundary.
A12—10 to 18 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; common very dark grayish brown (10YR 3/2) masses; weak medium subangular blocky structure; very friable; many very fine and fine tubular pores; slightly acid; clear wavy boundary.
B21—18 to 25 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium subangular blocky structure; many very fine and fine continuous and open tubular pores; slightly acid; clear wavy boundary.
B22—25 to 32 inches; dark brown (10YR 4/3) sandy loam; few faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; many very fine and fine open and continuous tubular pores; slightly acid; clear wavy boundary.
C1—32 to 46 inches; brown (10YR 5/3) sand; many medium faint gray (10YR 5/1) and common fine distinct yellowish brown (10YR 5/4) mottles; single grained; loose; slightly acid; abrupt wavy boundary.
C2—46 to 60 inches; gray (10YR 5/1) sand; many coarse distinct gray (10YR 5/1) mottles; few thin bands of loam; massive and single grained; loose; slightly acid.

The thickness of the solum ranges from 24 to 36 inches and that of the mollic epipedon from 10 to 20 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is slightly acid or medium acid. The B horizon has value of 4 or 5 and chroma of 2 or 3. The upper 30 inches of the solum has low chroma mottles in most pedons. The B horizon ranges from slightly acid to strongly acid. It typically is sandy loam, but in some pedons the lower part is loamy sand.

Joy series

The Joy series consists of deep, somewhat poorly drained soils that are moderately permeable. These soils formed in a thick layer of loess. They are on uplands. Slopes range from 1 to 4 percent.

Joy soils are similar to Littleton soils and are near Garwin, Mt. Carroll, and Port Byron soils. Littleton soils have a mollic epipedon that is thicker than that of Joy soils. Their position on the landscape is similar to that of Joy soils. Garwin soils are in drainageways and are poorly drained. Mt. Carroll and Port Byron soils are on summits and are well drained.

Typical pedon of Joy silt loam, 1 to 4 percent slopes, 120 feet north and 1,000 feet west of the southeast corner of NE1/4 sec. 31, T. 107 N., R. 15 W.

Ap—0 to 12 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; slightly acid; abrupt wavy boundary.

A12—12 to 20 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine and medium granular structure; friable; many very fine to medium continuous tubular pores; slightly acid; clear wavy boundary.

B21—20 to 24 inches; dark grayish brown (10YR 4/2) silt loam; common black (10YR 2/1) worm casts; moderate fine subangular blocky structure; friable; slightly acid; clear wavy boundary.

B22—24 to 30 inches; dark grayish brown (2.5Y 4/2) silt loam; common black (10YR 2/1) worm casts; moderate fine subangular blocky structure; friable; many very fine to medium tubular pores; slightly acid; clear wavy boundary.

B23—30 to 40 inches; olive brown (2.5Y 4/4) silt loam; many fine faint dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; friable; many very fine to medium tubular pores; slightly acid; clear wavy boundary.

B3—40 to 50 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; neutral; clear wavy boundary.

C—50 to 65 inches; grayish brown (2.5Y 5/2) silt loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; neutral.

The thickness of the solum ranges from 36 to 60 inches and that of the mollic epipedon from 10 to 24 inches. The depth to free carbonates ranges from 60 to 80 inches.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. It typically is silt loam but in some pedons is light silty clay loam. It is neutral or slightly acid. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 5. It has few to many high chroma mottles. It ranges from slightly acid to mildly alkaline.

Kalmarville series

The Kalmarville series consists of deep, poorly drained soils that are moderately permeable. These soils formed in alluvial sediments on bottom land. Slopes are less than 1 percent.

Kalmarville soils are near Becker and Radford soils. Becker soils are on the higher lying flood plains. Unlike Kalmarville soils, they are not stratified. Radford soils are fine-silty. Their position on the landscape is similar to that of Kalmarville soils.

Typical pedon of Kalmarville silt loam, 1,780 feet east and 2,120 feet north of the southwest corner of sec. 35, T. 106 N., R. 12 W.

A1—0 to 43 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; common and many fine strata of dark gray (10YR 4/1) fine sandy loam and silt loam; weak and moderate very thin to thick platy structure parting to weak and moderate fine granular; very friable; many very fine to medium tubular pores below 12 inches; few snail shells in the lower part; slight effervescence in the upper 12 inches; mildly alkaline; clear wavy boundary.

IIC—43 to 60 inches; dark gray (10YR 4/1) sand; single grained; loose; about 5 percent gravel; mildly alkaline.

Depth to the coarse textured IIC horizon ranges from 40 to 60 inches. The content of coarse fragments ranges from 0 to 5 percent in the A1 horizon and from 0 to 10 percent in the IIC horizon. Reaction is mildly alkaline or neutral throughout.

The A1 horizon has value of dominantly 3 or 4, but in some pedons the thin strata have value of 5. This horizon is mottled in some pedons. It is dominantly silt loam but has coarser textured strata in many pedons. The IIC horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is coarse sand, sand, or loamy fine sand.

Kasson series

The Kasson series consists of deep, moderately well drained soils that are moderately slowly permeable. These soils formed in a thin mantle of loess and in the underlying glacial till. They are mainly on summits on uplands that have low relief. Slopes range from 1 to 3 percent.

Kasson soils are near Racine and Skyberg soils. Racine soils are well drained and moderately well drained and are typically higher on the landscape than Kasson soils. Skyberg soils are lower on the landscape and are somewhat poorly drained.

Typical pedon of Kasson silt loam, 75 feet south and 50 feet east of the northwest corner of SE1/4 sec. 34, T. 106 N., R. 12 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine granular structure; friable; medium acid; abrupt smooth boundary.

B21t—9 to 13 inches; dark brown (10YR 4/3) heavy silt loam, pale brown (10YR 6/3) dry; fine very dark

grayish brown (10YR 3/2) root channels and worm casts; moderate medium platy structure parting to weak very fine subangular blocky; friable; common very fine and fine tubular pores; medium acid; clear wavy boundary.

B22t—13 to 22 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; friable; common very fine and fine tubular pores; strongly acid; abrupt wavy boundary.

IIB23—22 to 25 inches; yellowish brown (10YR 5/4) clay loam; many coarse faint yellowish brown (10YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; common very fine and fine tubular pores; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

IIB24—25 to 32 inches; yellowish brown (10YR 5/4) clay loam; many coarse distinct light gray (10YR 6/1) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; about 4 percent coarse fragments; strongly acid; clear wavy boundary.

IIB25—32 to 45 inches; light brownish gray (10YR 6/2) clay loam; light gray (10YR 7/1) coatings on faces of many prisms; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; about 4 percent coarse fragments; strongly acid; clear wavy boundary.

IIB3—45 to 55 inches; pale brown (10YR 6/3) clay loam; many medium faint light gray (10YR 6/1) mottles; moderate medium prismatic structure; firm; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

IIC—55 to 60 inches; brown (10YR 5/3) clay loam; weak coarse subangular blocky structure; friable; about 5 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 40 to 60 inches and that of the loess mantle from 16 to 24 inches. The depth to free carbonates ranges from 50 to 72 inches. The content of coarse fragments ranges from 2 to 8 percent in the lower part of the solum and in the underlying material.

The A1 horizon has value of 2 or 3 and chroma of 1 or 2. An A2 horizon occurs in some pedons. It is medium acid or slightly acid. The upper part of the B horizon has value of 4 or 5 and chroma of 3 or 4. This horizon has few to many faint, low chroma mottles. It is heavy silt loam or silty clay loam. The B and IIB horizons are strongly acid or medium acid. The IIB horizon has value of 4 to 6 and chroma of 2 to 4. It is loam, clay loam, or sandy clay loam. The IIC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. In some pedons it has common to many faint to prominent mottles. It is loam, clay loam, or sandy clay loam. It is strongly acid to mildly alkaline.

Kato series

The Kato series consists of deep, very poorly drained soils in drainageways on stream terraces. These soils are moderately permeable in the upper part and rapidly permeable in the underlying material. They formed in silty alluvium and in the underlying sandy material. Slopes are 0 to 1 percent.

The Kato soils in this county have a silty solum that is deeper over the sandy underlying material than is defined as the range for the Kato series. This difference, however, does not alter the use or behavior of the soils.

Kato soils are similar to Garwin and Marshan soils and are near Otter soils. Garwin soils are in drainageways. They are silty throughout. Marshan soils are on benches and in drainageways. They contain more sand in the solum than Kato soils and are shallower to coarse textured material. Otter soils are on flood plains. Part of their solum formed in more recent sediments.

Typical pedon of Kato silty clay loam, depressional, 60 feet south and 500 feet west of the northeast corner of sec. 28, T. 106 N., R. 15 W.

A1—0 to 11 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; sticky; neutral; abrupt smooth boundary.

A3g—11 to 16 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; sticky; common fine to medium tubular pores; neutral; clear wavy boundary.

B21g—16 to 22 inches; dark gray (10YR 4/1) silty clay loam; many fine distinct dark brown (10YR 4/3) mottles; weak fine subangular blocky structure; sticky; common fine to medium tubular pores; neutral; clear wavy boundary.

B22g—22 to 31 inches; gray (5Y 5/1) light silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; sticky; mildly alkaline; clear wavy boundary.

B23g—31 to 50 inches; grayish brown (2.5Y 5/2) light silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; common fine black (N 2/0) concretions; weak coarse subangular blocky structure; sticky; mildly alkaline; abrupt wavy boundary.

IIC1g—50 to 60 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand; massive; nonsticky; mildly alkaline; abrupt wavy boundary.

IIC2g—60 to 70 inches; grayish brown (10YR 5/2) sand; single grained; loose; mildly alkaline.

The solum is 40 to 50 inches thick. It is neutral or mildly alkaline. The depth to sandy or stratified loamy or sandy material ranges from 40 to 55 inches. The mollic epipedon is 10 to 20 inches thick.

The A horizon typically is silty clay loam, but the range includes silt loam. The B2g horizon has hue of 10YR to

5Y, value of 4 or 5, and chroma of 1 or 2. It has few to many high chroma mottles. It is silt loam or silty clay loam. The IIC horizon is gravelly loamy coarse sand, coarse sand, or sand. It has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 2 or 3.

Kegonsa series

The Kegonsa series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the underlying material. These soils formed in a silty mantle and in the underlying loamy and sandy outwash. They are mainly on outwash terraces but in some areas are on summits in the uplands. Slopes range from 0 to 6 percent.

Kegonsa soils are similar to Dowagiac and Waukee soils. Dowagiac soils contain more sand and gravel in the solum than Kegonsa soils. Their position on the landscape is similar to that of Kegonsa soils. Waukee soils have a mollic epipedon. They are on stream terraces.

Typical pedon of Kegonsa silt loam, 0 to 2 percent slopes, 280 feet east and 440 feet south of the northwest corner of SW1/4 sec. 9, T. 107 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slightly acid; abrupt wavy boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium platy structure; friable; medium acid; abrupt wavy boundary.

B21t—12 to 19 inches; dark brown (10YR 4/3) heavy silt loam; moderate medium subangular blocky structure; friable; many fine tubular pores; few thin clay films; common thin coatings of clean very fine sand and coarse silt; medium acid; clear wavy boundary.

B22t—19 to 25 inches; yellowish brown (10YR 5/4) heavy silt loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine to medium continuous pores; many thin clay films; strongly acid; abrupt wavy boundary.

IIB23t—25 to 29 inches; dark brown (10YR 4/3) stratified sandy clay loam; moderate coarse subangular blocky structure; friable; about 15 percent gravel, concentrated in the upper part; many moderately thick clay bridgings on sand grains or pebbles; slightly acid; clear irregular boundary.

IIC1—29 to 42 inches; yellowish brown (10YR 5/4) sand; single grained; loose; about 2 percent gravel; slightly acid; abrupt wavy boundary.

IIC2—42 to 60 inches; brown (10YR 5/3) very coarse sand; single grained; loose; mildly alkaline; slight effervescence.

The solum ranges from 26 to 40 inches in thickness and the silty mantle from 24 to 36 inches. The content of coarse fragments ranges from 0 to 12 percent in the IIB and IIC horizons.

The A1 or Ap horizon has value of 2 or 3 and chroma of 1 to 3. The A2 horizon has value of 4 to 6 and chroma of 2 or 3. Some pedons lack an A2 horizon. The B2t horizon has value of 3 to 5 and chroma of 3 or 4. It is heavy silt loam or silty clay loam. The IIB2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is loam, clay loam, sandy clay loam, or sandy loam. In some pedons tongues of the B2t horizon extend several feet into the C horizon. The IIC horizon has value of 4 to 6 and chroma of 2 to 6.

Kenyon series

The Kenyon series consists of deep, moderately well drained soils that are moderately slowly permeable. These soils are on summits in the uplands. They formed in loamy glacial sediments and in the underlying loamy glacial till. Slopes range from 1 to 6 percent.

Kenyon soils are similar to Ostrander soils and are adjacent to Maxfield, Floyd, and Readlyn soils. Ostrander soils are moderately permeable and are well drained. Maxfield and Floyd soils are lower on the landscape than Kenyon soils and are not so well drained. Readlyn soils also are not so well drained. They are on the nearly level parts of summits.

Typical pedon of Kenyon loam, 1 to 6 percent slopes, 150 feet south and 450 feet west of the northeast corner of SW1/4 sec. 31, T. 108 N., R. 14 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; medium acid; abrupt wavy boundary.

A3—8 to 13 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; many very dark brown (10YR 2/2) pore fillings; moderate fine granular structure; friable; medium acid; clear irregular boundary.

B21—13 to 18 inches; yellowish brown (10YR 5/4) clay loam; common dark brown (10YR 4/3) coatings on faces of peds; weak very fine granular structure; friable; many very fine and fine tubular pores; about 4 percent coarse fragments; medium acid; clear wavy boundary.

IIB22—18 to 28 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; friable; common very fine and fine tubular pores; about 4 percent coarse fragments; medium acid; clear wavy boundary.

IIB23—28 to 34 inches; yellowish brown (10YR 5/4) loam; brown (10YR 5/3) coatings on faces of peds; moderate fine prismatic structure parting to moderate fine angular blocky; firm; few very fine and fine tubular pores; about 5 percent coarse fragments; neutral; clear wavy boundary.

IIB24—34 to 41 inches; brown (10YR 5/3) loam; moderate medium prismatic structure; firm; few very fine

and fine tubular pores; about 5 percent coarse fragments; neutral; abrupt wavy boundary.

IIB3—41 to 50 inches; brown (10YR 5/3) loam; common medium faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; few very fine and fine tubular pores; about 5 percent coarse fragments; neutral; clear wavy boundary.

IIC—50 to 65 inches; brown (10YR 5/3) loam; many coarse faint grayish brown (10YR 5/2) and fine few distinct yellowish brown (10YR 5/6) mottles; massive; firm; few strata of silt loam; about 5 percent coarse fragments; friable; mildly alkaline; slight effervescence.

The thickness of the solum and the depth to free carbonates range from 45 to 66 inches. The thickness of the upper loamy sediments ranges from 14 to 24 inches. At least one stone line separates the loamy sediments from the glacial till. It is 2 to 6 inches thick and as much as 30 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It ranges from medium acid to neutral. It typically is loam and clay loam, but the range includes silt loam. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam. The IIB horizon has value of 4 or 5 and chroma of 4 to 6. The faces of peds have chroma of 2 or 3. Few to many mottles are below a depth of 30 inches. The B and IIB horizons range from strongly acid to neutral. The IIC horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6.

Lamont series

The Lamont series consists of deep, well drained soils that are moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. These soils formed in dominantly loamy material and in the underlying sandy or gravelly material. Slopes range from 2 to 6 percent.

Lamont soils are similar to Dickinson and Oronoco soils and are adjacent to Racine and Rockton soils. Dickinson soils have a thicker A horizon than Lamont soils. They are on stream terraces. Oronoco soils have silty underlying material. Their position on the landscape is similar to that of Lamont soils. Racine and Rockton soils contain more clay in the solum than Lamont soils.

Typical pedon of Lamont sandy loam, 2 to 6 percent slopes, 75 feet west and 980 feet south of the northeast corner of sec. 27, T. 106 N., R. 12 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; neutral; abrupt wavy boundary.

B21t—8 to 13 inches; yellowish brown (10YR 5/4) heavy sandy loam; many thin grayish brown (10YR 5/2) silt coatings on faces of peds; weak very fine subangular blocky structure; very friable; many very fine to large tubular pores; common thin clay films on faces of peds; neutral; clear wavy boundary.

B22t—13 to 20 inches; yellowish brown (10YR 5/4) loam; weak very fine subangular blocky structure; very friable; many very fine to medium tubular pores; many thin clay films on faces of peds; medium acid; clear wavy boundary.

B3—20 to 27 inches; yellowish brown (10YR 5/4) loamy sand; weak coarse subangular blocky structure; very friable; few thin lamellae of sandy loam; medium acid; clear wavy boundary.

A&B—27 to 60 inches; yellowish brown (10YR 5/4) fine sand (A2); single grained; loose; lamellae and bands of dark brown (10YR 4/3) sandy loam (B2t); weak very fine subangular blocky structure in the bands; very friable; smooth discontinuous lamellae 1/16 to 1/2 inch thick; slightly acid; gradual wavy boundary.

C—60 to 75 inches; yellowish brown (10YR 5/4) sand; single grained; loose; slightly acid; clear wavy boundary.

The thickness of the solum ranges from 30 to 60 inches. The A horizon has value of 3 or 4 and chroma of 2 or 3. It typically is sandy loam but is loam in some pedons. It is medium acid to neutral. An A2 horizon is in some pedons. The upper part of the B horizon has value and chroma of 4 or 5. It is sandy loam, sandy clay loam, or loam. The B horizon ranges from neutral to strongly acid. The C horizon is dominantly sand, but in some pedons it has thin layers of gravel.

Lawler series

The Lawler series consists of deep, somewhat poorly drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils formed in glacial outwash occurring as a loamy mantle and the underlying sandy material. They are on stream terraces. Slopes are 0 to 1 percent.

Lawler soils are similar to Waukee soils and are adjacent to Floyd and Marshan soils. Waukee soils are well drained. Their position on the landscape is similar to that of Lawler soils. Floyd soils formed entirely in loamy material. They are on side slopes above Lawler soils. Marshan soils are very poorly drained and are on the lower stream terraces.

Typical pedon of Lawler loam, 600 feet west and 900 feet north of the southeast corner of NW1/4 sec. 20, T. 106 N., R. 13 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; medium acid; abrupt wavy boundary.

A12—9 to 16 inches; black (10YR 2/1) heavy loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; many very fine to fine pores; medium acid; clear wavy boundary.

B1—16 to 23 inches; dark grayish brown (10YR 4/2) loam; moderate very fine subangular blocky structure; friable; many very fine to medium tubular pores; medium acid; clear wavy boundary.
B21—23 to 27 inches; dark grayish brown (10YR 4/2) loam; many medium faint brown (10YR 5/3) mottles; moderate fine subangular blocky structure; very friable; about 2 percent gravel; many very fine to medium tubular pores; medium acid; clear wavy boundary.
B22—27 to 33 inches; dark brown (10YR 4/3) loam; many coarse faint dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; very friable; about 2 percent gravel; slightly acid; abrupt wavy boundary.
IIB3—33 to 40 inches; brown (10YR 5/3) loamy sand; single grained; loose; about 5 percent gravel; medium acid; abrupt wavy boundary.
IIC1—40 to 55 inches; yellowish brown (10YR 5/4) loamy sand; many thin dark brown (7.5YR 4/4) bands; single grained; about 5 percent gravel; neutral; abrupt wavy boundary.
IIC2—55 to 70 inches; pale brown (10YR 6/3) sand; single grained; loose; about 10 percent gravel; mildly alkaline.

The thickness of the solum is 24 to 40 inches. The depth to free carbonates is 50 to 75 inches. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has chroma of 1 or 2. It is silt loam in some pedons. It ranges from medium acid to neutral. The B2 horizon has value of 4 or 5 and chroma of 2 or 3 and has few to many low chroma mottles. It is loam or silt loam and is medium acid or slightly acid. The IIC horizon has hue of 2.5Y, 10YR, or 7.5YR; value of 4 to 6; and chroma of 2 to 4. It is sand, coarse sand, gravelly sand, or loamy sand and ranges from 5 to 25 percent coarse fragments.

Lilah series

The Lilah series consists of deep, very rapidly permeable, excessively drained soils on uplands. These soils formed in coarse-loamy and sandy outwash. Slopes range from 6 to 12 percent.

Lilah soils are similar to Dowagiac and Salida soils. They are adjacent to those soils. Dowagiac soils contain more clay in the solum than Lilah soils. They are typically upslope from those soils. Salida soils have a thinner solum than Lilah soils and have free carbonates in the IIC horizon.

Typical pedon of Lilah sandy loam, 6 to 12 percent slopes, 265 feet east and 65 feet south of the northwest corner of SW1/4 sec. 10, T. 108 N., R. 15 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; about 10 percent gravel; medium acid; abrupt smooth boundary.
B21t—9 to 13 inches; dark yellowish brown (10YR 4/4) sandy loam; weak very fine and fine subangular blocky structure; very friable; about 10 percent gravel; common thin clay films on faces of peds; strongly acid; abrupt wavy boundary.
IIB22t—13 to 25 inches; dark brown (7.5YR 4/4) loamy coarse sand; weak coarse subangular blocky structure; very friable; about 20 percent coarse fragments ranging from as small as pebbles to as large as cobblestones; the very coarse material concentrated in a stone line; many thin to moderately thick clay bridgings on sand grains; strongly acid; clear wavy boundary.
IIB23t—25 to 56 inches; strong brown (7.5YR 5/8) gravelly loamy coarse sand; single grained; loose; about 40 percent gravel; many very thin clay films bridging sand grains and pebbles; strongly acid; clear irregular boundary.
IIC—56 to 70 inches; yellowish brown (10YR 5/6) coarse sand; single grained; about 20 percent fine gravel; neutral.

The solum ranges from 30 to 60 inches in thickness. The depth to loamy sand or coarser material is 8 to 15 inches. Reaction ranges from neutral to strongly acid throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is sandy loam but in some pedons is loam. The IIB horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 to 6; and chroma of 2 to 8. It is loamy sand in some pedons. The IIC horizon has hue of 10YR or 5YR and value and chroma of 4 to 6.

Lindstrom series

The Lindstrom series consists of deep, well drained soils that are moderately permeable. These soils formed in loess on concave foot slopes in the major stream valleys and on head slopes in the uplands. Slopes range from 2 to 15 percent.

Lindstrom soils are similar to Chaseburg, Eyota, and Port Byron soils. Chaseburg soils are in drainageways. They formed in recent alluvium. Eyota soils are on foot slopes. They have an A horizon of loamy sand or sandy loam. Port Byron soils are on summits or side slopes on uplands. They have a thinner mollic epipedon than Lindstrom soils.

Typical pedon of Lindstrom silt loam, 2 to 6 percent slopes, 1,380 feet west and 500 feet north of the southeast corner of NE1/4 sec. 12, T. 108 N., R. 13 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; neutral; abrupt wavy boundary.
A12—10 to 16 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; very friable; neutral; clear wavy boundary.
A13—16 to 23 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky

structure parting to moderate fine granular; very friable; many fine and medium continuous and open tubular pores; neutral; clear wavy boundary.

A14—23 to 27 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; many black (10YR 2/1) coatings on faces of peds; weak fine subangular blocky structure parting to medium fine granular; very friable; many very fine and fine tubular pores; medium acid; clear wavy boundary.

A3—27 to 31 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common large dark brown (10YR 4/3) masses; weak fine subangular blocky structure parting to moderate fine granular; common to many open tubular pores; slightly acid; clear wavy boundary.

B21—31 to 37 inches; dark brown (10YR 4/3) silt loam; common very dark grayish brown (10YR 3/2) worm casts; moderate fine subangular blocky structure; friable; many very fine and fine tubular pores; slightly acid; clear wavy boundary.

B22—37 to 44 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; many fine and very fine tubular pores; slightly acid; clear wavy boundary.

C—44 to 60 inches; yellowish brown (10YR 5/4) silt loam high in content of coarse silt; weak coarse subangular blocky structure; very friable; many very fine and fine tubular pores; slightly acid.

The thickness of the solum ranges from 40 to 70 inches and the depth to free carbonates from 50 to 80 inches. The mollic epipedon ranges from 24 to 54 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is silt loam, but the range includes loam. The B horizon has value of 3 to 5. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam, loam, or very fine sandy loam.

Littleton series

The Littleton series consists of deep, somewhat poorly drained soils that are moderately permeable. These soils formed in silty alluvium or loess on stream terraces and on the head and toe slopes of upland drainageways. Slopes range from 0 to 4 percent.

Littleton soils are similar to Lindstrom soils and are adjacent to Mt. Carroll, Otter, and Port Byron soils. Lindstrom, Mt. Carroll, and Port Byron soils are higher on the landscape than Littleton soils and are well drained. Also, Mt. Carroll soils have an argillic horizon. The very poorly drained Otter soils are on flood plains.

Typical pedon of Littleton silt loam, 1 to 4 percent slopes, 700 feet east and 800 feet north of the southwest corner of sec. 25, T. 106 N., R. 15 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; neutral; abrupt wavy boundary.

A12—8 to 25 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; moderate very fine granular structure; friable; many very fine to very large continuous pores; neutral; clear wavy boundary.

A13—25 to 32 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; moderate fine granular structure; friable; many very fine to large continuous pores; neutral; clear wavy boundary.

A3—32 to 40 inches; very dark grayish brown (10YR 3/2) heavy silt loam; many black (10YR 2/1) coatings on faces of peds; moderate fine subangular blocky structure; friable; many very fine to large continuous pores; neutral; clear wavy boundary.

B2—40 to 51 inches; dark brown (10YR 4/3) heavy silt loam; many medium faint grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; neutral; clear wavy boundary.

B3—51 to 61 inches; light yellowish brown (2.5Y 6/4) silt loam; many coarse faint gray (10YR 5/1) and common fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; mildly alkaline; gradual wavy boundary.

C—61 to 71 inches; grayish brown (10YR 5/2) silt loam; massive; friable; mildly alkaline.

The thickness of the solum ranges from 50 to 70 inches and that of the mollic epipedon from 24 to 40 inches. The depth to free carbonates ranges from 70 to 100 inches or more.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is slightly acid or neutral. The B2 horizon has value of 4 or 5 and chroma of 2 or 3. It has few to many low chroma mottles and is slightly acid or neutral. The C horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 1 to 3. It is dominantly silt loam, but in some pedons it is light silty clay loam, heavy loam, or light clay loam.

Marlean series

The Marlean series consists of deep, well drained soils that are moderately rapidly permeable. These soils formed in a thin loamy mantle and in the underlying loamy-skeletal sediments derived from fragmented limestone. They are on side slopes that face north and east. Slopes range from 25 to 80 percent.

Marlean soils are similar to Brodale soils and are near Dorerton and Elbaville soils. Brodale soils are on the warmer west- and south-facing slopes. Dorerton and Elbaville soils have an argillic horizon.

Typical pedon of Marlean silty clay loam, 40 to 80 percent slopes, 340 feet east and 1,300 feet north of the southwest corner of sec. 22, T. 105 N., R. 12 W.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; about 10 percent channers and flagstones; neutral; clear wavy boundary.

IIB2—10 to 18 inches; dark brown (10YR 3/3) flaggy silty clay loam; weak fine subangular blocky structure; friable; about 50 percent flagstones and some channers; slight effervescence; mildly alkaline; clear irregular boundary.

IIC—18 to 60 inches; dark brown (10YR 4/3) flaggy clay loam; massive; friable; about 70 percent flagstones and some channers; slight effervescence; mildly alkaline.

The solum ranges from 15 to 25 inches in thickness and from medium acid to mildly alkaline. The depth to bedrock ranges from 4 to 10 feet.

The A horizon typically is silty clay loam but in some pedons is silt loam or sandy loam. It is 5 to 10 inches thick. It has chroma of 1 or 2. Some pedons have a B horizon. The IIB horizon is flaggy silty clay loam, loam, or flaggy sandy loam. The IIC ranges from flaggy or channery sandy loam to flaggy or channery silty clay loam. The IIB and IIC horizons have chroma and value of 3 or 4. They range from 35 to 70 percent coarse fragments.

Marshan series

The Marshan series consists of deep, very poorly drained soils that are moderately permeable in the upper part and rapidly permeable in the underlying material. These soils are on low lying stream terraces. They formed in a mantle of loamy material and in the underlying sandy glacial outwash. Slopes are 1 percent or less.

Marshan soils are near Lawler and Waukee soils, which are better drained and are on higher lying terraces.

Typical pedon of Marshan silt loam, 740 feet south and 720 feet west of the northwest corner of SE1/4 sec. 18, T. 106 N., R. 11 W.

Ap—0 to 10 inches; black (N 2/0) silt loam, dark gray (10YR 4/1) dry; weak very fine granular structure; slightly sticky; neutral; abrupt wavy boundary.

A12—10 to 14 inches; black (N 2/0) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; slightly sticky; common medium continuous vertical tubular pores; neutral; clear wavy boundary.

A3—14 to 18 inches; very dark grayish brown (2.5Y 3/2) silt loam, gray (10YR 5/1) dry; common fine faint very dark gray (5Y 3/1) coatings on faces of peds; weak fine subangular blocky structure; slightly sticky; medium fine and very fine continuous black (N 2/0) vertical tubular pores; neutral; clear wavy boundary.

B21g—18 to 23 inches; dark gray (5Y 4/1) silt loam high in content of sand; weak fine subangular blocky structure; slightly sticky; few medium faint very dark gray (5Y 3/1) pore fillings; neutral; clear wavy boundary.

B22g—23 to 30 inches; olive gray (5Y 5/2) loam; many prominent yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; slightly sticky; common medium distinct very dark gray (5Y 3/1) tubular pore fillings; common very fine to large continuous vertical tubular pores; slightly acid; abrupt wavy boundary.

IIC1—30 to 40 inches; grayish brown (10YR 5/2) sand; many coarse distinct yellowish brown (10YR 5/4) mottles; single grained; loose; about 5 percent gravel; slightly acid; abrupt wavy boundary.

IIC2—40 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grained; loose; slightly acid.

The thickness of the solum, or depth to the IIC horizon, is 24 to 40 inches. The mollic epipedon is 10 to 20 inches thick. Reaction is slightly acid or neutral throughout the profile.

The A horizon has chroma of 0 to 2. It typically is silt loam, but the range includes clay loam and silty clay loam. The B horizon has hue of 5Y or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It has few to many prominent or distinct mottles. The IIC horizon typically is stratified sand, coarse sand, and gravel. It has many high chroma mottles or subhorizons that have hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6.

Massbach series

The Massbach series consists of deep, well drained and moderately well drained soils on summits and side slopes in the uplands. These soils formed in a thin mantle of loess and in material derived from the underlying shale. Permeability is moderate in the loess and very slow in the underlying material. Slopes range from 2 to 18 percent.

Massbach soils are similar to Elbaville and Frankville soils. They are adjacent to Schapville soils. Elbaville and Frankville soils formed in residuum of limestone bedrock. Their position on the landscape is similar to that of Massbach soils. Schapville soils are clayey and formed mainly in material derived from shale. They are on side slopes.

Typical pedon of Massbach silt loam, 6 to 12 percent slopes, 132 feet south and 660 feet west of the northeast corner of SE1/4 sec. 3, T. 107 N., R. 12 W.

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

B1—7 to 11 inches; dark brown (10YR 4/3) heavy silt loam; common very dark grayish brown (10YR 3/2)

worm casts; moderate very fine subangular blocky structure; friable; common very fine and fine tubular pores; neutral; clear wavy boundary.

B21t—11 to 20 inches; grayish brown (10YR 5/2) heavy silt loam; dark yellowish brown (10YR 4/4) coatings; moderate fine subangular blocky structure; friable; many very fine and fine tubular pores; few thin clay films; neutral; clear wavy boundary.

B22t—20 to 31 inches; yellowish brown (10YR 5/4) heavy silt loam; moderate fine subangular blocky structure; friable; common very fine and fine tubular pores; common thin clay films; neutral; clear wavy boundary.

B23t—31 to 37 inches; yellowish brown (10YR 5/4) silt loam; brown (10YR 5/3) coatings on faces of peds; many fine faint grayish brown (10YR 5/2) mottles; moderate very fine prismatic structure; friable; common thin clay films; slightly acid; abrupt wavy boundary.

IIB3—37 to 45 inches; greenish gray (5GY 5/1) clay; moderate coarse subangular blocky structure; extremely firm; neutral; abrupt wavy boundary.

IICr—45 inches; greenish gray (5GY 5/1) shale.

The solum is 40 to 50 inches thick. The thickness of the loess mantle is dominantly 30 to 40 inches but ranges from 30 to 50 inches. The A and B horizons are neutral to medium acid.

The Ap or A1 horizon has value and chroma of 2 or 3. Some pedons have an A2 horizon. The IIB horizon has hue of 10YR or 5GY. It is silty clay loam, silty clay, or clay. The IIC horizon contains few or common thin fragments of limestone that are as small as channers and as large as flagstones.

Maxfield series

The Maxfield series consists of deep, poorly drained soils that are moderately permeable. These soils are on head slopes and in drainageways on uplands. They formed in a silty loess mantle and in the underlying loamy glacial till. Slopes range from 0 to 2 percent.

Maxfield soils are similar to Garwin soils and are near Floyd, Kenyon, and Ostrander soils. Garwin soils are silty throughout. Their position on the landscape is similar to that of Maxfield soils. Floyd, Kenyon, and Ostrander soils are better drained than Maxfield soils. Floyd soils are on head slopes, and Kenyon and Ostrander soils are on summits and side slopes.

Typical pedon of Maxfield silty clay loam, 135 feet south and 230 feet west of the northeast corner of NW1/4 sec. 6, T. 107 N., R. 14 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak medium granular structure; very friable; neutral; clear wavy boundary.

A12—8 to 11 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to moderate fine and very fine granular; very friable; few fine and very fine tubular pores; slightly acid; clear wavy boundary.

A3—11 to 15 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; many medium distinct grayish brown (2.5Y 5/2) mottles; common black (10YR 2/1) worm or root pore fillings; weak medium subangular blocky structure parting to moderate very fine granular; friable; few very fine and fine continuous tubular pores; slightly acid; clear irregular boundary.

B21g—15 to 22 inches; grayish brown (2.5Y 5/2) silty clay loam; dark gray (10YR 4/1) coatings on faces of peds; common fine distinct light olive brown (2.5Y 5/4) mottles; few very dark gray (10YR 3/1) root and worm pore fillings; weak medium subangular blocky structure parting to moderate fine and very fine granular; friable, slightly sticky; medium acid; clear wavy boundary.

B22g—22 to 32 inches; grayish brown (2.5Y 5/2) silt loam; gray (5Y 5/1) coatings on faces of peds; many fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable, slightly sticky; medium acid; clear wavy boundary.

IIB23g—32 to 40 inches; yellowish brown (10YR 5/4) loam; many coarse prominent light gray (10YR 6/1) mottles; weak coarse subangular blocky structure; friable, slightly sticky; slightly acid; gradual irregular boundary.

IIC—40 to 60 inches; yellowish brown (10YR 5/4) loam; many coarse distinct light gray (10YR 6/1) mottles; massive; firm, slightly sticky; neutral.

The thickness of the solum ranges from 40 to 60 inches and that of the loess mantle from 24 to 40 inches.

The A horizon is 10 to 20 inches thick. It typically is silty clay loam but in some pedons is silt loam. It is slightly acid or neutral. The B horizon has hue of 5Y or 2.5Y, value of 4 or 5, and chroma of 1 to 3. It has few to many distinct or prominent high chroma mottles. It is medium acid to neutral. The upper part of this horizon is silty clay loam or silt loam. The IIB and IIC horizons have value of 4 or 5 and chroma of 3 to 6.

Minneiska series

The Minneiska series consists of deep, moderately well drained soils that are moderately rapidly permeable. These soils formed in alluvium on low lying bottom land along streams. Slopes are less than 1 percent.

The Minneiska soils in Olmsted County lack the fine stratification in the solum characteristic of the Minneiska series, and they have sand and gravel within a depth of 40 inches. These differences, however, do not alter the use or behavior of the soils.

Minneiska soils are similar to Kalmarville soils and are adjacent to Spillville soils. Kalmarville soils are poorly

drained and are frequently flooded. Spillville soils are fine-loamy and have a thicker solum than Minneiska soils.

Typical pedon of Minneiska loam, occasionally flooded, 1,485 feet west and 2,211 feet south of the northeast corner of sec. 27, T. 108 N., R. 15 W.

Ap—0 to 6 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; about 4 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

A12—6 to 15 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very friable; many very fine to medium tubular pores; about 4 percent pebbles; slight effervescence; mildly alkaline; abrupt wavy boundary.

A3—15 to 36 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; about 5 percent pebbles; many very fine and fine tubular pores; slight effervescence; mildly alkaline; clear wavy boundary.

B2—36 to 39 inches; dark grayish brown (10YR 4/2) sandy loam; weak fine subangular blocky structure; very friable; many very fine to medium tubular pores; common very dark grayish brown (10YR 3/2) worm casts; about 5 percent pebbles; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC—39 to 60 inches; dark grayish brown (10YR 4/2) gravelly coarse sand; single grained; loose; about 20 percent pebbles; slight effervescence; mildly alkaline.

Depth to the underlying sandy material is 36 to 45 inches. The coarse-loamy mantle ranges from 0 to 10 percent and the sandy underlying material from 5 to 25 percent coarse fragments, mostly pebbles.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is loam but in some pedons is sandy loam. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3. It is mottled in some pedons. It is sandy loam or loam. The IIC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. The fine earth fraction is coarse sand, sand, loamy coarse sand, or loamy sand.

Mt. Carroll series

The Mt. Carroll series consists of deep, well drained soils that are moderately permeable. These soils formed in deep loess on summits and side slopes in the uplands. Slopes range from 2 to 25 percent.

Mt. Carroll soils are similar to Port Byron soils and are adjacent to Lindstrom and Littleton soils. Unlike those soils, they do not have a mollic epipedon. Port Byron and Mt. Carroll soils are in similar positions on the landscape. Lindstrom and Littleton soils are on concave head slopes.

Typical pedon of Mt. Carroll silt loam, 2 to 6 percent slopes, 495 feet south and 627 feet west of the northeast corner of NW1/4 sec. 17, T. 107 N., R. 12 W.

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

A2—7 to 12 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; dark grayish brown (10YR 4/2) coatings on faces of peds; weak medium platy structure; very friable; medium acid; clear wavy boundary.

B21t—12 to 19 inches; dark yellowish brown (10YR 4/4) heavy silt loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; common thin clay films; many thin clean silt and very fine sand coatings on faces of peds; medium acid; clear wavy boundary.

B22t—19 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; common thin clay films on faces of peds and on inside faces of pores; few thin clean silt and very fine sand coatings on faces of peds; medium acid; clear wavy boundary.

B23—26 to 40 inches; yellowish brown (10YR 5/4) silt loam high in content of coarse silt; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; few thin clay films on faces of peds; medium acid; clear wavy boundary.

B3—40 to 51 inches; yellowish brown (10YR 5/4) silt loam high in content of coarse silt; moderate medium subangular blocky structure; very friable; many medium tubular pores; medium acid; clear wavy boundary.

C—51 to 72 inches; yellowish brown (10YR 5/4) silt loam high in content of coarse silt; weak coarse subangular blocky structure; very friable; medium acid.

The solum ranges from 30 to 54 inches in thickness. The Ap horizon has value of 3 or 4. It is slightly acid or neutral. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B2t and C horizons have value of 4 or 5 and chroma of 3 or 4.

Nasset series

The Nasset series consists of deep, well drained soils that are moderately permeable. These soils formed in a mantle of loess and a thin layer of limestone residuum. They are on summits and side slopes on broad uplands. Slopes range from 2 to 12 percent.

Nasset soils are near Frankville and Mt. Carroll soils and are similar to those soils and to Waucoma soils.

Frankville soils are shallower to limestone bedrock than Nasset soils. Their position on the landscape is similar to that of Nasset soils. Mt. Carroll soils formed in a thick layer of loess. They are near the summits of hills. Waucoma soils contain more sand than Nasset soils. Their position on the landscape is similar to that of Nasset soils.

Typical pedon of Nasset silt loam, 2 to 6 percent slopes, 100 feet west and 240 feet north of the southeast corner of NW1/4 sec. 18, T. 105 N., R. 12 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; medium acid; abrupt wavy boundary.

B1—6 to 12 inches; dark brown (10YR 4/3) silt loam; moderate medium platy structure parting to moderate very fine subangular blocky; friable; strongly acid; abrupt wavy boundary.

B21t—12 to 17 inches; yellowish brown (10YR 5/4) heavy silt loam; dark brown (10YR 4/3) coatings on faces of peds; strong very fine subangular blocky structure; friable; common thin clean very fine sand coatings on faces of peds; few thin clay films on faces of peds; common medium tubular pores; strongly acid; abrupt wavy boundary.

B22t—17 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; dark brown (10YR 4/3) coatings on faces of peds; strong fine subangular blocky structure; friable; few thin coatings and many thin clay films on faces of peds; common medium pores; strongly acid; abrupt wavy boundary.

B23t—27 to 37 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common thin clay films; common medium pores; strongly acid; abrupt wavy boundary.

IIB24—37 to 44 inches; dark brown (7.5YR 4/4) clay; moderate medium angular blocky structure; extremely firm; many fine clay films on faces of peds; slightly acid; abrupt wavy boundary.

IIR—44 inches; somewhat weathered limestone; fractured with dark brown (7.5YR 4/4) clay tongues penetrating the vertical joints.

The thickness of the solum, or the depth to bedrock, ranges from 40 to 60 inches. Reaction is slightly acid or medium acid in the A horizon and slightly acid to strongly acid in the B and IIB horizons.

The A1 horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon. This horizon has value of 4 or 5 and chroma of 2 or 3. The B2 horizon has chroma of 3 or 4. The IIB horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is clay, silty clay, or channery or flaggy clay, and it ranges from 0 to 50 percent coarse fragments.

Oronoco series

The Oronoco series consists of deep, well drained soils that are moderately permeable. These soils formed in loamy sediments and in the underlying loess. They are on summits and side slopes in the uplands. Slopes range from 2 to 18 percent.

Oronoco soils are similar to Mt. Carroll and Timula soils, which are in similar positions on the landscape. These similar soils contain less sand in the solum.

Typical pedon of Oronoco loam, 6 to 12 percent slopes, 2,340 feet south and 820 feet east of the northwest corner of sec. 24, T. 108 N., R. 14 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine and very fine continuous pores; neutral; abrupt smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; friable; many fine and very fine continuous pores; few faint very dark grayish brown (10YR 3/2) masses; neutral; clear wavy boundary.

B1t—11 to 16 inches; brown (10YR 5/3) loam; moderate medium subangular blocky structure; friable; many fine continuous pores and few medium discontinuous pores; few thin coatings of clean sand and silt grains on faces of peds; few thin discontinuous clay films in pores; slightly acid; clear wavy boundary.

B21t—16 to 23 inches; brown (10YR 5/3) fine sandy loam; moderate medium subangular blocky structure; friable; many fine continuous pores and few medium discontinuous pores; few thin coatings of clean sand and silt grains on faces of peds; few thin discontinuous clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—23 to 34 inches; yellowish brown (10YR 5/4) fine sandy loam; moderate medium subangular blocky structure; very friable; many fine continuous pores; few thin discontinuous clay films on faces of peds; medium acid; clear wavy boundary.

B31—34 to 45 inches; brown (10YR 5/3) fine sandy loam; weak medium prismatic structure; very friable; many fine continuous pores and few medium discontinuous pores; thin discontinuous clay films on faces of peds; medium acid; clear wavy boundary.

B32—45 to 74 inches; pale brown (10YR 6/3) loam; few fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; very friable; many very fine discontinuous pores; medium acid; clear wavy boundary.

IIC—74 to 77 inches; light yellowish brown (2.5Y 6/4) silt loam; few fine distinct light olive brown (2.5Y 5/6) mottles; massive; very friable; many very fine discontinuous pores; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 48 to 84 inches. Depth to the underlying silty sediments ranges from 50 to more than 100 inches.

The A horizon typically is loam but is fine sandy loam in some pedons. It is slightly acid or neutral. The Ap or A1 horizon has value of 2 or 3 and chroma of 1 to 3. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has value of 4 to 6 and chroma of 3 or 4. It is medium acid or slightly acid. It is dominantly fine sandy loam, but in most pedons the upper part is loam. A IIB3 or C1 horizon is in some pedons. The IIC horizon has hue of 10YR or 2.5Y and chroma of 3 or 4.

Ostrander series

The Ostrander series consists of deep, well drained soils that are moderately permeable. These soils formed in loamy glacial drift and in the underlying loamy glacial till. They typically are on summits and side slopes on broad uplands. Slopes range from 0 to 12 percent.

Ostrander soils are similar to Floyd, Kenyon, and Racine soils. They are near those soils. Floyd soils are somewhat poorly drained and typically are on slopes below Ostrander soils. Kenyon soils are moderately well drained and typically are near the summits of uplands. Racine soils do not have a mollic epipedon. Their position on the landscape is similar to that of Ostrander soils.

Typical pedon of Ostrander loam, 2 to 6 percent slopes, 1,070 feet west and 1,100 feet south of the northeast corner of SE1/4 sec. 31, T. 108 N., R. 14 W.

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

A3—8 to 14 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; many root or worm pores filled with very dark brown (10YR 2/2) material; weak very fine subangular blocky structure; friable; many very fine and fine tubular pores; slightly acid; clear wavy boundary.

B21—14 to 18 inches; yellowish brown (10YR 5/4) loam; many dark brown (10YR 4/3) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; many very fine and fine tubular pores; slightly acid; abrupt wavy boundary.

IIB22—18 to 29 inches; yellowish brown (10YR 5/4) loam; weak very fine subangular structure; friable; many very fine to large pores; about 10 percent fine gravel; slightly acid; clear wavy boundary.

IIB23—29 to 40 inches; dark yellowish brown (10YR 4/4) heavy loam; moderate fine subangular blocky structure; friable; many medium to large tubular pores; about 10 percent gravel; slightly acid; clear wavy boundary.

IIB3—40 to 48 inches; dark brown (10YR 4/3) loam; few fine faint grayish brown (10YR 5/2) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; about 4 percent fine gravel; neutral; clear wavy boundary.

IIC—48 to 70 inches; brown (10YR 5/3) loam; many faint gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; about 4 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 44 to 70 inches. The thickness of the upper sediments ranges from 14 to 24 inches. The content of coarse fragments, mostly pebbles, is as much as 6 percent in the upper sediments. It is 2 to 10 percent in the underlying glacial till. In places at least one stone line, in which the content of coarse fragments is as much as 30 percent, separates the upper sediments from the glacial till.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is medium acid to neutral. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is strongly acid to slightly acid. The IIB horizon is sandy clay loam, light clay loam, or loam. The IIC horizon has value of 4 or 5 and chroma of 3 to 6. It is loam or light clay loam.

Otter series

The Otter series consists of deep, very poorly drained soils in upland drainageways. These soils are moderately permeable. They formed in recent alluvium. Slopes range from 0 to 2 percent.

Otter soils are similar to Radford soils and are adjacent to Littleton, Garwin, and Mt. Carroll soils. They are more poorly drained than all of those soils. Mt. Carroll soils are steeper than Otter soils, and Garwin soils lack the stratification characteristic of Otter soils.

Typical pedon of Otter silt loam, channeled, 200 feet north and 300 feet west of the southeast corner of sec. 23, T. 105 N., R. 12 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; few fine distinct dark brown (7.5YR 3/2) mottles; weak very fine granular structure; very friable; neutral; abrupt wavy boundary.

A12—8 to 14 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; common fine prominent dark brown (7.5YR 3/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; slightly sticky; neutral; abrupt wavy boundary.

A13—14 to 22 inches; black (N 2/0) mucky silt loam, very dark gray (10YR 3/1) dry; weak very fine granular structure; slightly sticky; few fine tubular pores; neutral; clear wavy boundary.

A14—22 to 30 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak medium granular structure; slightly sticky; neutral; clear wavy boundary.

A3—30 to 38 inches; very dark gray (10YR 3/1) silt loam; weak medium subangular blocky structure;

slightly sticky; mildly alkaline; clear irregular boundary.

Cg—38 to 65 inches; greenish gray (5GY 5/1) silt loam; massive; slightly sticky; mildly alkaline.

The A horizon ranges from 24 to 40 inches in thickness. It has value of dominantly 2 or 3 and chroma of 0 to 2. In some pedons it has strata with value of 4 or more. It typically is silt loam, mucky silt loam, and silty clay loam, but the range includes loam and mucky silty clay loam. The C horizon has hue of 5Y or 5GY, value of 4 or 5, and chroma of 1 or 2. It is silt loam or silty clay loam.

Palms series

The Palms series consists of deep, very poorly drained, organic soils that are moderately slowly permeable. These soils formed in organic material derived primarily from herbaceous plants and in the underlying loamy glacial drift. They are mainly on toe slopes. Slopes range from 1 to 6 percent.

Palms soils are near Kenyon, Maxfield, Ostrander, and Otter soils. None of these nearby soils are organic in the upper part. Kenyon and Ostrander soils are on summits in the uplands, and Otter and Maxfield soils are in drainageways.

Typical pedon of Palms muck, 1 to 6 percent slopes, 900 feet south and 720 feet west of the center of sec. 21, T. 105 N., R. 15 W.

Oa1—0 to 9 inches; black (10YR 2/1) sapric material; moderate very fine granular structure; very friable; about 60 percent mineral material; mildly alkaline; abrupt wavy boundary.

Oa2—9 to 16 inches; very dark brown (10YR 2/2) broken face sapric material, black (N 2/0) rubbed; massive; about 30 percent fiber, 5 percent rubbed; massive; slightly sticky; herbaceous fiber; about 30 percent mineral material; mildly alkaline; abrupt wavy boundary.

Oa3—16 to 24 inches; black (N 2/0) broken face and rubbed sapric material; about 15 percent fiber, 5 percent rubbed; massive; slightly sticky; herbaceous fiber; about 35 percent mineral material; slight effervescence; mildly alkaline; abrupt wavy boundary.

Oa4—24 to 33 inches; very dark brown (10YR 2/2) broken face sapric material, black (N 2/0) rubbed; massive; about 30 percent fiber, 5 percent rubbed; massive; slightly sticky; herbaceous fiber; about 30 mineral material; slight effervescence; mildly alkaline; abrupt wavy boundary.

A1b—33 to 38 inches; black (N 2/0) mucky silty clay loam; massive; slightly sticky; mildly alkaline; abrupt wavy boundary.

A3b—38 to 45 inches; very dark gray (N 3/0) silty clay loam; massive; sticky; mildly alkaline; abrupt wavy boundary.

Cg—45 to 60 inches; greenish gray (5GY 6/1) silty clay loam; massive; sticky; mildly alkaline.

The organic material ranges from 16 to 51 inches in thickness. It has free carbonates. In some pedons it underlies a thin surface horizon of mucky silt loam or mucky silty clay loam.

The organic part of the control section is dominantly sapric material. The organic material either has value of 2 or 3 and chroma of 1 or 2 or is neutral in hue and has value of 2 or 3 and chroma of 0. The chroma is 2 only on broken faces. The content of fibrous material is 0 to 35 percent unrubbed and less than 15 percent rubbed. The content of mineral material ranges from 25 to 70 percent; the higher content is in the upper part. The organic material is neutral or mildly alkaline. A few pedons have layers of hemic material as thick as 10 inches.

The Ab horizon either has hue of 10YR to 5Y, value of 2 or 3, and chroma of 1 or is neutral in hue and has value of 2 or 3 and chroma of 0. It is loam, silt loam, clay loam, silty clay loam, or mucky silty clay loam. The Cg horizon has hue of 2.5Y to 5G and value of 4 to 6. Its texture is similar to that of the Ab horizon.

Plainfield series

The Plainfield series consists of deep, excessively drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy outwash. Slopes range from 0 to 30 percent.

Plainfield soils are adjacent to Waukee and Dickinson soils. Both of these adjacent soils have a mollic epipedon and a loamy solum.

Typical pedon of Plainfield loamy sand, 0 to 6 percent slopes, 600 feet south and 800 feet west of the northeast corner of sec. 17, T. 106 N., R. 13 W.

A1—0 to 4 inches; very dark brown (10YR 2/2) loamy sand, very dark grayish brown (10YR 3/2) dry; single grained; loose; about 2 percent fine gravel; strongly acid; abrupt irregular boundary.

A2—4 to 10 inches; dark grayish brown (10YR 4/2) loamy sand, grayish brown (10YR 5/2) dry; single grained; loose; about 2 percent gravel; strongly acid; clear wavy boundary.

B2—10 to 21 inches; dark brown (10YR 4/3) sand; single grained; loose; about 2 percent gravel; strongly acid; clear wavy boundary.

C1—21 to 30 inches; brown (10YR 5/3) sand; single grained; loose; medium acid; abrupt wavy boundary.

C2—30 to 53 inches; brown (10YR 5/3) sand; single grained; loose; medium acid; abrupt wavy boundary.

C3—53 to 65 inches; brown (10YR 5/3) sand; single grained; loose; few thin strata of dark yellowish brown (10YR 4/4) loamy sand as much as 1/4 inch thick; slightly acid.

The solum ranges from 18 to 34 inches in thickness. It is medium acid or strongly acid. The sand throughout the control section is dominantly medium in size, but as much as 25 percent is coarse or very coarse. The content of fine gravel is 0 to 5 percent.

The A horizon has value of 2 to 4. It typically is loamy sand, but the range includes sand. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is sand or loamy sand. The C horizon has value of 5 or 6.

Port Byron series

The Port Byron series consists of deep, well drained soils that are moderately permeable. These soils formed in loess. They are on broad uplands. Slopes range from 0 to 9 percent.

Port Byron soils are similar to Mt. Carroll soils and are adjacent to Garwin, Joy, and Lindstrom soils. Mt. Carroll soils lack a mollic epipedon. Their position on the landscape is similar to that of Port Byron soils. Garwin and Joy soils are more poorly drained than Port Byron soils and are in drainageways. Lindstrom soils have a thicker mollic epipedon than Port Byron soils.

Typical pedon of Port Bryon silt loam, 1 to 5 percent slopes, 1,300 feet east and 200 feet south of the northwest corner of sec. 13, T. 108 N., R. 13 W.

Ap—0 to 6 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; slightly acid; abrupt wavy boundary.

A12—6 to 12 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many very fine to medium tubular pores; slightly acid; abrupt wavy boundary.

A3—12 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; many very fine to medium tubular pores; slightly acid; abrupt wavy boundary.

B21—15 to 19 inches; dark brown (10YR 4/3) silt loam; many very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; slightly acid; clear wavy boundary.

B22—19 to 25 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; slightly acid; clear wavy boundary.

B23—25 to 32 inches; dark yellowish brown (10YR 4/4) silt loam; weak moderate subangular blocky structure; very friable; many very fine to medium tubular pores; slightly acid; clear wavy boundary.

B3—32 to 46 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; very friable; many very fine to medium tubular pores; neutral; clear wavy boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; very friable; neutral.

The thickness of the solum ranges from 36 to 60 inches and that of the mollic epipedon from 12 to 24 inches. The depth to free carbonates typically is more than 60 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is slightly acid or medium acid. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is medium acid to neutral. The C horizon has hue of 10YR or 2.5Y and chroma of 3 to 6.

Racine series

The Racine series consists of deep, well drained and moderately well drained, moderately permeable soils on glacial uplands. These soils formed in erosional sediments and in the underlying glacial till. Slopes range from 1 to 18 percent.

Racine soils are similar to Coggon and Ostrander soils and are adjacent to Floyd and Maxfield soils. Coggon soils are moderately well drained. Their position on the landscape is similar to that of Racine soils. Ostrander soils also are in similar positions on the landscape. They have a mollic epipedon. The somewhat poorly drained Floyd soils are lower on the landscape than Racine soils. The poorly drained Maxfield soils are mainly in drainageways.

Typical pedon of Racine silt loam, 1 to 6 percent slopes, 990 feet north and 380 feet east of the southwest corner of NW1/4 sec. 35, T. 105 N., R. 14 W.

A1—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; friable; many fine fibrous roots; medium acid; abrupt wavy boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium platy structure; very friable; many fine very dark brown (10YR 2/2) tubular pore fillings; medium acid; abrupt wavy boundary.

B21t—12 to 18 inches; dark yellowish brown (10YR 4/4) clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium very fine subangular blocky structure; friable; common very fine and fine open tubular pores; few thin clay films on faces of peds; strongly acid; abrupt wavy boundary.

IIB22t—18 to 28 inches; dark yellowish brown (10YR 4/4) clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; common very fine and fine open continuous tubular pores; few thin clay films on faces of peds; about 3 percent coarse fragments; strongly acid; abrupt wavy boundary.

IIB23t—28 to 40 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate medium subangular blocky structure; friable; common fine continuous tu-

bular pores; few thin horizontal and vertical strata of sand; few thin clay films on faces of peds; about 10 percent coarse fragments; strongly acid; abrupt wavy boundary.

IIB3t—40 to 46 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate medium prismatic structure; friable; common thick pores lined or filled with dark brown (10YR 3/3) clay; common very fine and fine continuous open tubular pores; about 8 percent coarse fragments; neutral; clear wavy boundary.

IIC1—46 to 55 inches; brown (10YR 5/3) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; about 8 percent coarse fragments; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC2—55 to 65 inches; brown (10YR 5/3) loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; about 8 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 64 inches. The depth to free carbonates ranges from 40 to 70 inches. The thickness of the upper sediments ranges from 14 to 24 inches. In many pedons a thin layer ranging to as much as 15 percent coarse fragments separates the upper sediments from the glacial till. The A horizon is slightly acid or medium acid, and the B horizon and most parts of the IIB horizon are medium acid or strongly acid.

The A1 or Ap horizon has value of 2 or 3 and chroma of 1 or 2. It typically is silt loam but in some pedons is loam. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. It does not occur in some pedons. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam, silty clay loam, or clay loam. The IIB horizon has value of 4 to 6 and chroma of 3 to 5. It is clay loam, sandy clay loam, or loam.

Radford series

The Radford series consists of deep, somewhat poorly drained soils that are moderately permeable. These soils formed in alluvium on low lying flood plains. Slopes are 0 to 2 percent.

Radford soils are similar to Arenzville and Otter soils and are near Littleton and Sawmill soils. Arenzville and Otter soils and the Radford soils are in similar positions on the landscape. Arenzville soils are moderately well drained and Otter soils very poorly drained. Littleton and Sawmill soils are on the higher parts of flood plains and have not accumulated a significant amount of recent sediments.

Typical pedon of Radford silt loam, 280 feet south and 1,000 feet east of the northwest corner of SW1/4 sec. 31, T. 105 N., R. 11 W.

A1—0 to 12 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; very friable; mildly alkaline; slight effervescence; clear wavy boundary.

C1—12 to 29 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; few thin grayish brown (10YR 5/2) strata; weak medium platy structure; friable; many very fine to medium pores; mildly alkaline; slight effervescence; clear wavy boundary.

A12b—29 to 38 inches; black (N 2/0) silt loam; moderate medium subangular blocky structure; friable; many very fine to medium pores; mildly alkaline; slight effervescence; clear wavy boundary.

A13b—38 to 52 inches; black (10YR 2/1) silt loam; many prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common very fine and fine tubular pores; mildly alkaline; clear wavy boundary.

B2gb—52 to 72 inches; dark gray (10YR 4/1) silt loam; weak medium subangular blocky structure; slightly sticky; mildly alkaline.

The solum ranges from 8 to 20 inches in thickness. It formed in recent sediments 15 to 35 inches thick. The buried solum ranges from 25 to 50 inches in thickness. Reaction is neutral or mildly alkaline throughout the profile.

The A1 horizon has value of 2 or 3 and chroma of 1 or 2. The C1 horizon has value of dominantly 3 and chroma of 1 or 2. It has few to many strata with value of 4 or 5. The Ab and Bb horizons are silt loam or silty clay loam.

Readlyn series

The Readlyn series consists of deep, somewhat poorly drained soils that are moderately slowly permeable. These soils formed in a thin layer of loamy sediments and in the underlying firm glacial till. A thin stone line separates the loamy sediments from the glacial till. The soils are on side slopes on uplands that have low relief. Slopes range from 0 to 3 percent.

Readlyn soils are similar to Kasson and Kenyon soils and are near Maxfield soils. Kasson soils lack a mollic epipedon. Their position on the landscape is similar to that of Readlyn soils. Kenyon soils are moderately well drained and are on summits. Maxfield soils are poorly drained and are in drainageways or on head slopes.

Typical pedon of Readlyn loam, 600 feet south and 740 feet west of the northeast corner of NE1/4 sec. 28, T. 105 N., R. 15 W.

Ap—0 to 7 inches; black (10YR 2/1) loam high in content of silt, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; medium acid; abrupt wavy boundary.

A12—7 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; clear wavy boundary.

A3—10 to 16 inches; very dark grayish brown (10YR 3/2) loam high in content of silt, grayish brown

(10YR 5/2) dry; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; medium acid; clear wavy boundary.

B21—16 to 22 inches; dark grayish brown (10YR 4/2) loam high in content of silt; dark gray (10YR 4/1) coatings on faces of peds; common medium faint dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; friable; many very fine and fine tubular pores; strongly acid; abrupt wavy boundary.

IIB22—22 to 32 inches; yellowish brown (10YR 5/4) loam; dark gray (10YR 4/1) coatings on faces of peds; common medium faint dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; firm; about 8 percent coarse fragments occurring mostly as a thin stone line at the top of the horizon; common very fine and fine tubular pores; strongly acid; clear wavy boundary.

IIB23—32 to 44 inches; yellowish brown (10YR 5/4) loam; common medium faint grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; common very fine and fine tubular pores; about 4 percent coarse fragments of mixed lithology; slightly acid; clear wavy boundary.

IIC—44 to 65 inches; brown (10YR 5/3) loam; common medium distinct strong brown (7.5YR 5/6) and gray (10YR 6/1) mottles; moderate coarse subangular blocky structure; very firm; very few pores; about 6 percent coarse fragments of mixed lithology; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. The A horizon has chroma of 1 or 2. It is medium acid to neutral. The B2 horizon has chroma of 2 or 3 and has few or common mottles. The IIB horizon has value of 4 or 5 and chroma of 3 or 4. It has few to many low or high chroma mottles. It ranges from strongly acid to neutral. The IIC horizon has value of 5 or 6 and chroma of 3 to 6.

Richwood series

The Richwood series consists of deep, well drained, moderately permeable soils on low lying outwash plains and stream terraces. These soils formed in a mantle of silty and loamy sediments over outwash sand. Slopes are 0 to 2 percent.

Richwood soils are similar to the Port Byron soils and are adjacent to Littleton and Radford soils. Port Byron soils lack an argillic horizon. They are on uplands. Littleton soils are somewhat poorly drained. Their position on the landscape is similar to that of Richwood soils. Radford soils are on the lower lying flood plains and are somewhat poorly drained.

Typical pedon of Richwood silt loam, 0 to 2 percent slopes, 200 feet north and 620 feet west of the southeast corner of sec. 4, T. 107 N., R. 15 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak very fine granular structure; very friable; about 2 percent fine gravel; slightly acid; clear wavy boundary.

A12—10 to 16 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak very fine subangular blocky structure; friable; many very fine to medium tubular pores; about 1 percent fine gravel; neutral; clear wavy boundary.

A3—16 to 24 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; many very dark grayish brown (10YR 3/2) coatings on faces of peds; weak fine subangular blocky structure; friable; many very fine to medium tubular pores; about 1 percent fine gravel; neutral; clear wavy boundary.

B21t—24 to 34 inches; dark brown (10YR 4/3) silt loam; common very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine and medium subangular blocky structure; friable; many very fine to medium tubular pores; common thin clay films and few thin clean very fine sand grains on faces of peds and in pores; neutral; clear wavy boundary.

B22t—34 to 40 inches; yellowish brown (10YR 5/4) silt loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; few thin clay films in pores; medium acid; clear wavy boundary.

B23t—40 to 50 inches; yellowish brown (10YR 5/4) loam; weak very fine prismatic structure; friable; common very fine to medium tubular pores; about 4 percent gravel; medium acid; abrupt wavy boundary.

IIB24t—50 to 59 inches; dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; very friable; many thin clay bridgings on sand grains and pebbles; about 10 percent gravel; slightly acid; clear irregular boundary.

IIC—59 to 70 inches; brown (10YR 5/3) sand; single grained; loose; about 4 percent gravel; mildly alkaline.

The thickness of the solum ranges from 50 to 60 inches and that of the mollic epipedon from 20 to 32 inches. The solum ranges from medium acid to neutral.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The B2 horizon has value of 4 or 5 and chroma of 3 to 5. It is silt loam, loam, or light silty clay loam and has few to many clay films. The content of coarse fragments is as much as 20 percent in the IIB horizon. The IIC horizon has value of 4 to 6 and chroma of 3 or 4. It is slightly acid to mildly alkaline.

Rockton series

The Rockton series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in a mantle of loamy glacial drift over lime-

stone bedrock residuum. Slopes range from 0 to 12 percent.

Rockton soils are similar to Whalan soils and are near Atkinson and Channahon soils. Their position on the landscape is similar to that of all of those soils. Atkinson soils have a thicker solum than Rockton soils, and Channahon soils are shallower to bedrock. Whalan soils lack a mollic epipedon.

Typical pedon of Rockton loam, 1 to 6 percent slopes, 170 feet south and 1,295 feet west of the northeast corner of sec. 31, T. 106 N., R. 12 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; slightly acid; abrupt wavy boundary.

A3—10 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; medium acid; clear irregular boundary.

B21t—15 to 21 inches; dark brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine angular blocky structure; very friable; many fine and very fine pores; few thin clay films on faces of peds; about 3 percent coarse fragments; medium acid; clear wavy boundary.

B22t—21 to 26 inches; dark yellowish brown (10YR 4/4) sandy clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; many very fine and fine pores; thin continuous clay films on faces of peds and clay bridging on sand grains; about 3 percent coarse fragments; strongly acid; clear wavy boundary.

IIB3—26 to 31 inches; dark yellowish brown (10YR 4/4) clay; moderate fine subangular blocky structure; firm; continuous clay films on faces of peds; about 6 percent coarse fragments; medium acid; clear wavy boundary.

IIR—31 inches; limestone bedrock; weathered along joints and partly fractured in the upper 2 feet.

The thickness of the solum, or the depth to limestone bedrock, ranges from 20 to 40 inches. The solum ranges from 0 to 6 percent coarse fragments of mixed lithology.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is loam, but in some pedons it is sandy loam or silt loam. It is medium acid or slightly acid. The B horizon has value of 4 or 5. It is strongly acid to slightly acid. It is loam, sandy clay loam, or clay loam. The IIB horizon is clay loam, silty clay loam, clay, or silty clay.

Root series

The Root series consists of deep, poorly drained soils that are moderately permeable in the upper part and very rapidly permeable in the lower part. These soils formed in a loamy mantle of recent alluvium over fragmental sediments. They are on flood plains. Slopes range from 1 to 4 percent.

Root soils are near Brodale, Minneiska, and Marlean soils. Brodale and Marlean soils are on valley walls and are better drained than Root soils. Minneiska soils are moderately well drained. They do not have a high content of coarse fragments in the IIC horizon.

Typical pedon of Root silt loam, 900 feet west and 1,960 feet south of the northeast corner of sec. 21, T. 105 N., R. 13 W.

A11—0 to 17 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; many thin dark grayish brown (10YR 4/2) strata; few fine distinct dark brown (7.5YR 3/2) mottles; moderate thin platy structure; very friable; mildly alkaline; abrupt wavy boundary.

A12—17 to 34 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; few strata of channery loam; common fine distinct dark brown (7.5YR 3/2) mottles; moderate medium platy structure; very friable; few thick strata of channery loam; mildly alkaline; abrupt wavy boundary.

IIC—34 to 50 inches; very dark gray (10YR 3/1) channery loam; common medium distinct dark brown (7.5YR 3/2) mottles; massive; very friable; about 30 percent channers and 20 percent gravel; strong effervescence; mildly alkaline.

Depth to the IIC horizon ranges from 20 to 40 inches. The A horizon generally has value of 2 or 3 and chroma of 1 but has subhorizons with value of 4 or 5 and chroma of 2. It typically is silt loam, but in some pedons it is coarser textured and ranges to 35 percent coarse fragments. It is neutral or mildly alkaline. The IIC horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It has few to many mottles. It is sandy loam, fine sandy loam, loam, or silt loam in the fine earth fraction and ranges from 35 to 90 percent coarse fragments, dominantly channers. It is mildly alkaline or moderately alkaline.

Salida series

The Salida series consists of deep, excessively drained soils that are very rapidly permeable. These soils formed in sandy and gravelly glacial outwash. They are on dissected valley trains and kames. Slopes range from 12 to 35 percent.

Salida soils are similar to Dowagiac and Lilah soils. They are near those soils. Dowagiac soils have an argillic horizon. Lilah soils have a thicker solum than Salida soils.

Typical pedon of Salida gravelly sandy loam, 12 to 35 percent slopes, 1,200 feet west and 820 feet south of the northeast corner of SE1/4 sec. 21, T. 108 N., R. 14 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; about 15 percent coarse fragments, mostly pebbles; mildly alkaline; abrupt wavy boundary.

A3—6 to 12 inches; very dark grayish brown (10YR 3/2) gravelly loamy coarse sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; about 15 percent coarse fragments, mostly pebbles; mildly alkaline; abrupt wavy boundary.

B2—12 to 18 inches; dark yellowish brown (10YR 4/4) gravelly coarse sand; very dark grayish brown (10YR 3/2) masses; single grained; loose; about 40 percent coarse fragments; mildly alkaline; abrupt wavy boundary.

C1—18 to 32 inches; yellowish brown (10YR 5/4) loosely cemented gravel; massive; slight effervescence; mildly alkaline; abrupt wavy boundary.

C2—32 to 60 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grained; loose; about 40 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 7 to 20 inches and the depth to carbonates from 10 to 25 inches. The content of coarse fragments ranges from 35 to 50 percent in the control section.

The A horizon has value of 2 or 3. It typically is gravelly sandy loam and gravelly loamy coarse sand, but the range includes loamy sand and gravelly loamy sand. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is gravelly coarse sand or gravelly loamy coarse sand. The C horizon has chroma of 3 or 4. It is gravel, coarse sand, or gravelly coarse sand.

Sawmill series

The Sawmill series consists of deep, poorly drained soils that are moderately slowly permeable. These soils formed in alluvium. They are on flood plains. Slopes are 0 to 1 percent.

Sawmill soils are similar to Kato, Littleton, Otter, and Radford soils. Kato soils typically are in drainageways. They have a thinner mollic epipedon than Sawmill soils. Littleton soils are somewhat poorly drained. Otter and Radford soils are on the lower lying flood plains. Part of their solum contains recent stratified sediments.

Typical pedon of Sawmill silty clay loam, 395 feet north and 1,120 feet east of the southwest corner of sec. 33, T. 107 N., R. 14 W.

A11—0 to 10 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry, weak very fine granular structure; friable; slightly sticky; neutral; abrupt wavy boundary.

A12—10 to 18 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine granular structure; friable; many very fine to medium tubular pores; neutral; clear wavy boundary.

A13—18 to 25 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; slightly sticky; common very fine to medium tubular pores; neutral; clear wavy boundary.

A14—25 to 30 inches; black (5Y 2/1) silty clay loam, dark gray (10YR 4/1) dry; few medium prominent strong brown (7.5YR 5/6) channel fillings; strong medium angular blocky structure; friable; slightly sticky; neutral; clear wavy boundary.

B2g—30 to 41 inches; dark gray (5Y 4/1) silty clay loam; very dark gray (5Y 3/1) coatings on faces of peds; many coarse prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate fine prismatic structure; friable; few medium and large tubular pores; neutral; gradual wavy boundary.

Cg—41 to 65 inches; gray (5Y 5/1) silty clay loam; many medium strong brown (7.5YR 5/6) mottles; massive; firm; mildly alkaline.

The thickness of the solum ranges from 36 to 54 inches and that of the mollic epipedon from 24 to 36 inches. Reaction is neutral or slightly acid in the solum and mildly alkaline or moderately alkaline in the C horizon.

The A horizon typically is silty clay loam, but the range includes heavy silt loam. The B2g horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is silt loam, silty clay loam, or clay loam. The C horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is silty clay loam or silt loam. In some pedons coarse textured material is within a depth of 60 inches.

Schapville series

The Schapville series consists of moderately deep, moderately well drained soils that are very slowly permeable. These soils formed in a thin mantle of loess and in material derived from the underlying calcareous shale. They are on side slopes and summits in the uplands. Slopes range from 6 to 25 percent.

The Schapville soils in Olmsted County have a thinner mantle of loess than is defined as the range for the Schapville series. Also, they lack an argillic horizon. These differences, however, do not affect the use and behavior of the soils.

Schapville soils are near Brodale, Shullsburg, and Sogn soils. Brodale soils formed in loamy material containing many limestone fragments. Shullsburg soils contain less clay in the upper part of the solum than Schapville soils. They are mainly on foot slopes below the Schapville soils. Sogn soils have limestone bedrock at a depth of 20 inches or less. They are on shoulders near the summits of hills.

Typical pedon of Schapville silty clay loam, 12 to 25 percent slopes, 540 feet south and 500 feet east of the northwest corner of NE1/4 sec. 10, T. 107 N., R. 15 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular struc-

ture; slightly sticky; few channers and flagstones; mildly alkaline; clear wavy boundary.
A3—7 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; strong very fine angular blocky structure; slightly sticky; mildly alkaline; clear wavy boundary.
IIB2—15 to 20 inches; olive brown (2.5Y 4/4) clay; common medium distinct unoxidized masses of greenish gray (5GY 6/1) shale; weak medium subangular blocky structure; sticky; about 5 percent limestone channers; slight effervescence; mildly alkaline; gradual wavy boundary.
IICr—20 to 60 inches; greenish gray (5GY 6/1) shale; massive; extremely firm; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 15 to 30 inches. The solum ranges to as much as 10 percent flagstones or channers. It ranges from medium acid to mildly alkaline.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is silty clay loam but is heavy silt loam or silty clay in some pedons. The B horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 3 to 5. It is silty clay or clay. The C horizon is greenish gray, gray, or bluish gray clay or soft shale.

Shullsburg series

The Shullsburg series consists of moderately deep, somewhat poorly drained soils that are slowly permeable. These soils are on foot slopes in the uplands. They formed in silty sediments and in material derived from the underlying shale. Slopes range from 2 to 12 percent.

Shullsburg soils are similar to Haverhill soils and are near those soils and Marlean and Schapville soils. Haverhill soils are on foot slopes and are very poorly drained. Marlean soils are steep and very steep and are on side slopes. They formed in fragmented material that is mostly of limestone lithology. Schapville soils are on side slopes and are moderately well drained.

Typical pedon of Shullsburg silt loam, 2 to 6 percent slopes, 1,230 feet south and 1,000 feet east of the northwest corner of sec. 3, T. 107 N., R. 15 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; neutral; abrupt wavy boundary.
A3—10 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate very fine granular structure; friable; many very fine tubular pores; slightly acid; gradual irregular boundary.
B21t—17 to 23 inches; dark grayish brown (10YR 4/2) silty clay loam; many very dark grayish brown (10YR 3/2) coatings on faces of peds; common medium distinct yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; friable; few thin clay films on faces of peds; slightly acid; clear wavy boundary.
B22t—23 to 26 inches; dark brown (10YR 4/3) silty clay loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; common fine faint grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; friable; common thin clay films on faces of peds; slightly acid; gradual wavy boundary.
IIB23t—26 to 31 inches; yellowish brown (10YR 5/6) clay; few coarse prominent greenish gray (5GY 6/1) mottles; strong fine angular blocky structure; firm; many very fine and fine tubular pores; common thick black clay films; slightly acid; gradual wavy boundary.
IIB3—31 to 37 inches; yellowish brown (10YR 5/4) clay; many medium distinct greenish gray (5GY 6/1) mottles; weak coarse prismatic structure; extremely firm; few fine and very fine tubular pores; common black clay films in fine pores; slightly acid; gradual wavy boundary.
IICr—37 to 60 inches; greenish gray (5GY 6/1) shale; many coarse prominent yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure; extremely firm; slight effervescence; mildly alkaline.

The thickness of the solum, or the depth to shale bedrock, ranges from 20 to 40 inches. The thickness of the loess mantle is 15 to 30 inches. The solum ranges to as much as 15 percent fragments of unweathered shale, limestone, and sandstone. It is slightly acid or neutral.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is typically silt loam, but the range includes silty clay loam. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. The IIB horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 to 6. The B and IIB horizons are silty clay loam, silt loam, silty clay, heavy silty clay loam, or clay. The C horizon has hue of 5GY, 5BG, or 2.5Y; value of 4 to 6; and chroma of 1 or 2.

Skyberg series

The Skyberg series consists of deep, somewhat poorly drained soils that are moderately slowly permeable. These soils formed in a mantle of loess and in the underlying glacial till. They are above drainageways on broad uplands. Slopes are 0 to 2 percent.

Skyberg soils are similar to Kasson soils. They are adjacent to those soils. Kasson soils are moderately well drained and are on summits.

Typical pedon of Skyberg silt loam, 880 feet west and 1,220 feet north of the southeast corner of NW1/4 sec. 19, T. 105 N., R. 14 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; slightly acid; abrupt smooth boundary.
A2—6 to 11 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; many medium

faint brown (10YR 5/3) mottles; moderate very thin platy structure; very friable; many very fine to medium tubular pores; many thin continuous coatings of clean coarse silt and very fine sand on faces of peds; slightly acid; clear irregular boundary.

B1—11 to 15 inches; grayish brown (10YR 5/2) silty clay loam; many medium faint brown (10YR 5/3) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; many very fine to medium tubular pores; continuous clean coatings of very fine sand and silt on faces of peds; strongly acid; clear irregular boundary.

B21—15 to 24 inches; grayish brown (10YR 5/2) silty clay loam; common medium faint brown (10YR 5/3) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; many very fine to medium tubular pores; continuous clean coatings of very fine sand and silt on faces of peds; very strongly acid; abrupt wavy boundary.

IIB22t—24 to 29 inches; yellowish brown (10YR 5/6) fine sandy loam; moderate fine prismatic structure; friable; common very fine to medium tubular pores; many clean coatings of very fine sand and silt on faces of peds; many clay films in pores; about 10 percent coarse fragments; strongly acid; clear irregular boundary.

IIB23t—29 to 34 inches; yellowish brown (10YR 5/4) loam; many medium faint grayish brown (10YR 5/2) mottles; few light gray coatings on faces of peds; moderate medium prismatic structure; very firm; few very fine and fine tubular pores; many thin clay films on some prism faces and in pores; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

IIB3—34 to 46 inches; yellowish brown (10YR 5/4) loam; many medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; very firm; few fine pores; few thin clay films in pores and on faces of peds; about 4 percent coarse fragments; strongly acid; clear wavy boundary.

IIC—46 to 70 inches; brown (10YR 5/3) loam; many medium faint gray (10YR 6/1) mottles; massive; friable; about 6 percent coarse fragments; medium acid.

The thickness of the solum ranges from 40 to 65 inches and that of the upper mantle from 16 to 24 inches. The depth to free carbonates is 65 inches or more.

The A horizon is slightly acid or medium acid. The A1 or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 4 or 5 and chroma of 1 or 2. The B and IIB2 horizons have value of 4 to 6. The B horizon has chroma of 1 or 2. The IIB2 horizon has chroma of 3 to 6. It has few to many low chroma mottles. The B and IIB2 horizons are strongly acid or very strongly acid. The B horizon is silty clay loam, heavy silt loam, or light clay loam, and the IIB2 horizon is dominantly loam and heavy loam and thin layers of fine sandy loam to loamy sand. The IIC horizon has value and chroma of 3 to 6. It ranges from medium acid to mildly alkaline.

Sogn series

The Sogn series consists of somewhat excessively drained, moderately permeable soils that are shallow over limestone bedrock. These soils are on the upper summits and shoulders of hills on dissected terrain. Slopes range from 4 to 12 percent.

Sogn soils are similar to Channahon soils and are near Brodale soils. Channahon soils are leached in the upper part of the solum. Their position on the landscape is similar to that of Sogn soils. Brodale soils do not have lithic contact within a depth of 20 inches. They typically are downslope from Sogn soils, on back slopes that make up the escarpments of valley walls. They are moderately steep to very steep.

Typical pedon of Sogn loam, 4 to 12 percent slopes, 360 feet south and 800 feet west of the northeast corner of NW1/4 sec. 21, T. 106 N., R. 15 W.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; very fine granular structure; friable; about 20 percent channers; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC—8 to 12 inches; broken limestone fragments as small as channers and as large as flagstones; mildly alkaline; strong effervescence; abrupt wavy boundary.

IIR—12 inches; hard limestone.

The thickness of the solum and the depth to hard limestone range from 6 to 20 inches. The A horizon has value and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. As much as 35 percent of the solum is coarse fragments.

Spillville series

The Spillville series consists of deep, moderately well drained soils that are moderately permeable. These soils formed in alluvium on flood plains. Slopes are 0 to 2 percent.

Spillville soils are similar to Littleton soils and are adjacent to Kalmarville and Radford soils. Littleton soils are on the higher lying terraces and are somewhat poorly drained. Kalmarville and Radford soils are on the lower lying flood plains and are more poorly drained than Spillville soils.

Typical pedon of Spillville silt loam, 300 feet west and 300 feet north of the southeast corner of NW1/4 sec. 24, T. 106 N., R. 15 W.

Ap—0 to 7 inches; black (10YR 2/1) heavy silt loam high in content of sand, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; slightly acid; abrupt wavy boundary.
A12—7 to 29 inches; black (10YR 2/1) silt loam high in content of sand, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many very fine to medium pores; neutral; clear wavy boundary.
A13—29 to 39 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) coatings on faces of peds; weak very fine prismatic structure; many very fine to medium tubular pores; about 1 percent gravel; neutral; clear wavy boundary.
B21—39 to 45 inches; dark grayish brown (10YR 4/2) loam; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; many very fine to medium tubular pores; about 1 percent gravel; neutral; clear wavy boundary.
B22—45 to 52 inches; grayish brown (10YR 5/2) loam; few medium faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; friable; common medium tubular pores; about 1 percent gravel; neutral; clear wavy boundary.
B3—52 to 60 inches; grayish brown (10YR 5/2) loam; common coarse distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; mildly alkaline; abrupt smooth boundary.
IIC—60 to 70 inches; grayish brown (10YR 5/2) coarse sand; single grained; loose; about 10 percent fine gravel; mildly alkaline.

The thickness of the solum and the depth to free lime range from 40 to 60 inches. The thickness of the mollic epipedon ranges from 24 to 60 inches. The depth to underlying sand ranges from 55 to 70 inches.

The A and B2 horizons are slightly acid or neutral. The B horizon has value of 4 or 5 and chroma of 2 or 3. It has few to many low or high chroma mottles. It is dominantly loam, but in some pedons it is silt loam and in others the lower part is sandy loam.

Terril series

The Terril series consists of deep, moderately well drained soils that are moderately permeable in the upper part and rapidly permeable in the underlying material. These soils typically are on the head slopes of drainageways in the uplands. Slopes range from 1 to 6 percent.

Terril soils are similar to Eyota and Lindstrom soils and are near Kegonsa and Waukee soils. Eyota soils typically are on foot slopes. They contain more sand in the upper part of the solum than Terril soils. Lindstrom soils are on head slopes and foot slopes. They are silty throughout. Kegonsa and Waukee soils are on stream benches. They do not have the very thick mollic epipedon characteristic of Terril soils.

Typical pedon of Terril loam, sandy substratum, 1 to 6 percent slopes, 1,250 feet south and 40 feet east of the northwest corner of SE1/4 sec. 21, T. 108 N., R. 14 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.
A12—9 to 18 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; many very fine to medium tubular pores; neutral; clear wavy boundary.
A13—18 to 25 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; friable; many very fine to medium tubular pores; neutral; clear wavy boundary.
A3—25 to 31 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; about 3 percent gravel; neutral; clear wavy boundary.
B21—31 to 37 inches; dark brown (10YR 3/3) loam; moderate medium subangular blocky structure; friable; many large tubular pores; about 5 percent gravel; neutral; clear wavy boundary.
B22—37 to 45 inches; dark brown (10YR 3/3) loam; moderate coarse subangular blocky structure; friable; many large tubular pores; about 7 percent gravel; neutral; clear wavy boundary.
IIC—45 to 60 inches; brown (10YR 5/3) coarse sand; single grained; loose; about 10 percent gravel; neutral.

The thickness of the solum, or depth to the IIC horizon, ranges from 40 to 60 inches. The mollic epipedon is 24 to 35 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is loam but is silt loam in some pedons. The B horizon has value of 3 to 5 and chroma of 3 or 4. In some pedons it has few to common low chroma mottles. It typically is loam, but the lower part is sandy loam in some pedons. The IIC horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 to 6. It is coarse sand or gravelly loamy coarse sand.

Timula series

The Timula series consists of deep, well drained, moderately permeable soils on summits and side slopes in the uplands. These soils formed in thick deposits of loess. Slopes range from 6 to 30 percent.

Timula soils are similar to Lindstrom, Oronoco, and Mt. Carroll soils. They are adjacent to those soils. Lindstrom soils have a mollic epipedon. They are on foot slopes. Mt. Carroll and Oronoco soils have an argillic horizon. Their position on the landscape is similar to that of Timula soils.

Typical pedon of Timula silt loam, 6 to 12 percent slopes, 420 feet south and 730 feet west of the northeast corner of sec. 17, T. 108 N., R. 14 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; very friable; neutral; abrupt smooth boundary.

B2—7 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; very friable; many very fine to medium tubular pores; neutral; clear wavy boundary.

B3—13 to 20 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; very friable; many very fine to medium tubular pores; neutral; clear wavy boundary.

C1—20 to 30 inches; yellowish brown (10YR 5/4) silt loam; massive; very friable; common fine pores; mildly alkaline; clear wavy boundary.

C2—30 to 70 inches; yellowish brown (10YR 5/4) silt loam; very friable; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 30 inches. Reaction is slightly acid to mildly alkaline throughout the profile.

The A horizon has value of 3 or 4 and chroma of 2 or 3. It is typically silt loam but in some pedons is loam, very fine sand, or very fine sandy loam. The B horizon has value of 4 or 5 and chroma of 3 or 4. It ranges from silt loam to very fine sandy loam. The C horizon has value of 4 to 6 and chroma of 3 or 4. It is silt loam, very fine sand, or very fine sandy loam.

Vasa series

The Vasa series consists of deep, moderately well drained, moderately permeable soils on the head slopes of drainageways in the uplands. These soils formed in loess. Slopes range from 0 to 3 percent.

Vasa soils are similar to Kasson soils and are near Mt. Carroll and Garwin soils. Kasson soils formed mainly in glacial till. Mt. Carroll soils typically are upslope from Vasa soils and are steeper than those soils. They are well drained. Garwin soils are poorly drained and are in drainageways.

Typical pedon of Vasa silt loam, 1,160 feet east and 280 feet north of the southwest corner of sec. 29, T. 108 N., R. 15 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common dark brown (10YR 4/3) masses; weak fine granular structure; friable; neutral; abrupt wavy boundary.

A2—7 to 14 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; friable; many fine and very fine tubular pores; neutral; clear wavy boundary.

B21t—14 to 20 inches; dark yellowish brown (10YR 4/4) silt loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; many very thin clean coatings of very fine sand and silt on faces of peds; few thin clay films in pores and on faces of peds; slightly acid; clear wavy boundary.

B22t—20 to 31 inches; brown (10YR 5/3) silt loam; common fine faint grayish brown (10YR 5/2) and few fine distinct dark brown (10YR 3/3) and brownish yellow (10YR 6/6) mottles; moderate fine subangular blocky structure; friable; many very fine to medium tubular pores; many very thin clean coatings of silt on faces of peds; common thin clay films on faces of peds and in pores; strongly acid; clear wavy boundary.

B23—31 to 38 inches; brown (10YR 5/3) silt loam; common medium faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) and dark brown (10YR 3/3) mottles; moderate medium subangular blocky structure; friable; many very fine to medium tubular pores; common thin clay films on faces of peds; medium acid; clear wavy boundary.

B3—38 to 45 inches; grayish brown (10YR 5/2) silt loam; many medium faint brown (10YR 5/3) and few fine distinct dark brown (10YR 3/3) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; many very fine and fine tubular pores; common thin clay films in pores and on faces of peds; medium acid; clear wavy boundary.

C—45 to 60 inches; grayish brown (10YR 5/2) silt loam; few fine distinct dark brown (10YR 3/3) and yellowish brown (10YR 5/6) and many medium faint brown (10YR 5/3) mottles; weak coarse subangular blocky structure; friable; neutral.

The solum ranges from 40 to 65 inches in thickness. The loess mantle is 60 to 80 inches deep over glacial till. The depth to free carbonates is more than 50 inches.

The A horizon is neutral to medium acid. The A1 or Ap horizon is 6 to 9 inches thick. It has value of 2 or 3. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has value of 4 or 5. It has chroma of 3 or 4 in the upper part and chroma of 2 in the lower part. It typically is silt loam in which the content of clay is 20 to 26 percent. In some pedons, however, it is light silty clay loam. The lower part of the B horizon has few to many faint or distinct mottles with chroma of 1 to 6. It is medium acid or strongly acid. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. It is silt loam or coarse silt loam that is high in content of coarse silt and very fine sand.

Waubeek series

The Waubeek series consists of deep, well drained and moderately well drained, moderately permeable soils on summits and side slopes on broad uplands. These soils formed in a mantle of loess and in the underlying glacial till. Slopes range from 1 to 12 percent.

Waubeek soils are near Mt. Carroll and Vasa soils. Neither of these nearby soils has glacial till in the lower part of the solum. Vasa soils have a seasonal high water table. They are lower on the landscape than Waubeek soils. The landscape position of Mt. Carroll soils is similar to that of Waubeek soils.

Typical pedon of Waubeek silt loam, 1 to 6 percent slopes, 1,320 feet north and 130 feet west of the southeast corner of SW1/4 sec. 9, T. 107 N., R. 12 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; neutral; abrupt wavy boundary.

A2—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; common to many very dark grayish brown (10YR 3/2) worm casts and rodent mixings; weak fine subangular blocky structure; very friable; many very fine to large tubular pores; slightly acid; abrupt wavy boundary.

B21t—13 to 21 inches; yellowish brown (10YR 5/4) silt loam; dark brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; many very fine to medium tubular pores; common thin clay films; medium acid; clear wavy boundary.

B22t—21 to 27 inches; yellowish brown (10YR 5/4) silt loam; dark yellowish brown (10YR 4/4) coatings on faces of peds; moderate medium subangular blocky structure; friable; many very fine and fine tubular pores; many very thin clay films on faces of peds; medium acid; clear wavy boundary.

B23—27 to 33 inches; brown (10YR 5/3) silt loam; common fine faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; medium acid; clear wavy boundary.

IIB3—33 to 45 inches; olive brown (2.5Y 4/4) loam; brown (10YR 5/3) coatings on faces of peds; weak medium subangular blocky structure; friable; about 4 percent coarse fragments; slightly acid; clear wavy boundary.

IIC—45 to 70 inches; olive brown (2.5Y 4/4) loam; massive; firm; about 4 percent coarse fragments; mildly alkaline.

The thickness of the solum ranges from 42 to 60 inches and that of the loess mantle from 24 to 36 inches. The depth to free carbonates is more than 50 inches; in many pedons it is 100 inches or more.

The A horizon ranges from neutral to medium acid. The A1 or Ap horizon has value of 2 or 3. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has value of 4 or 5 and chroma of 3 to 5. It has few or common low chroma mottles. It is silt loam or light silty clay loam. It is strongly acid or medium acid. The IIB and IIC horizons have hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 3 to 5. They are loam or light clay loam.

Waucoma series

The Waucoma series consists of deep, well drained, moderately permeable soils formed in glacial drift over limestone. These soils are on summits and side slopes in the uplands. Slopes range from 2 to 6 percent.

The landscape position of Waucoma soils is similar to that of Atkinson, Coggon, and Whalan soils. Atkinson soils have a mollic epipedon. The underlying material of Coggon soils is not bedrock. Whalan soils are more shallow over bedrock than Waucoma soils.

Typical pedon of Waucoma loam, 2 to 6 percent slopes, 920 feet north and 945 feet west of the southeast corner of NE1/4 sec. 1, T. 108 N., R. 14 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; black (10YR 2/1) coatings on faces of granules; moderate fine granular structure; very friable; many very fine to medium open and continuous tubular pores; neutral; abrupt wavy boundary.

A2—6 to 12 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; few black (10YR 2/1) worm casts and filled root pores; weak fine platy structure; very friable; many very fine to medium continuous and open tubular pores; neutral; clear irregular boundary.

B1—12 to 17 inches; dark yellowish brown (10YR 4/4) loam; common very dark brown (10YR 2/2) and dark brown (10YR 4/3) filled root pores and worm casts; moderate very fine and fine subangular blocky structure; friable; many very fine to medium continuous open tubular pores; medium acid; clear irregular boundary.

B21—17 to 21 inches; dark yellowish brown (10YR 4/4) loam; moderate very fine and fine subangular blocky structure; friable; many very fine to medium tubular pores; about 4 percent coarse fragments; medium acid; clear wavy boundary.

B22t—21 to 30 inches; dark yellowish brown (10YR 4/4) loam; moderate fine and medium subangular blocky structure; friable; many very fine and fine continuous and open tubular pores; about 4 percent coarse fragments; few thin clay films in fine pores and on faces of peds; medium acid; clear wavy boundary.

B23t—30 to 45 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; many very fine and fine continuous tubular pores; about 5 percent coarse fragments; few thin clay films on faces of peds and in fine pores; medium acid; clear wavy boundary.

IIB24t—45 to 55 inches; yellowish brown (10YR 5/6) clay; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; many fine and medium continuous tubular pores; common moderately thick clay films on faces of peds and in pores; neutral; abrupt wavy boundary.

IIR—55 inches; hard fractured limestone; some joints containing clay.

The solum ranges from 40 to 55 inches in thickness. It is as much as 10 percent coarse fragments.

The A horizon is neutral or slightly acid. It typically is loam, but the range includes silt loam. The A1 horizon has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B2 horizon has value of 4 or 5 and chroma of 3 to 6. It is loam, clay loam, or silt loam. The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The limestone bedrock has many to few joints.

Waukee series

The Waukee series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the underlying material. These soils formed in loamy alluvium and in the underlying sandy material. They are on stream terraces. Slopes range from 0 to 6 percent.

Waukee soils are similar to Dickinson and Kegonsa soils and are adjacent to those soils and to Spillville soils. Dickinson soils are coarse-loamy in the upper part, and Kegonsa soils are fine-silty in the upper part. Spillville soils are moderately well drained. They have a thicker mollic epipedon than Waukee soils.

Typical pedon of Waukee loam, 0 to 2 percent slopes, 360 feet north and 1,300 feet east of the southwest corner of NE1/4 sec. 24, T. 106 N., R. 15 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; medium acid; abrupt wavy boundary.

A12—7 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; many very dark brown (10YR 2/2) tubular pore fillings; moderate very fine granular structure; many very fine and medium tubular pores; medium acid; abrupt wavy boundary.

B1—10 to 16 inches; dark brown (10YR 4/3) heavy loam; dark grayish brown (10YR 4/2) coatings on faces of peds; common very dark brown (10YR 2/2) tubular pore fillings; moderate very fine subangular blocky structure; very friable; many very fine to large tubular pores; medium acid; clear wavy boundary.

B21t—16 to 25 inches; dark brown (10YR 4/3) heavy loam; moderate fine and medium subangular blocky structure; friable; many very fine to large tubular pores; about 4 percent gravel; common thin coatings of clean silt and sand particles on faces of peds; many very thin very dark grayish brown (10YR 3/2) clay films on faces of peds; strongly acid; abrupt wavy boundary.

B22t—25 to 31 inches; dark yellowish brown (10YR 4/4) sandy loam; few very dark grayish brown (10YR 3/2) tubular pore fillings; moderate medium subangular blocky structure; friable; many very fine to large tubular pores; about 10 percent gravel; common thin very dark grayish brown (10YR 3/2) clay films on faces of peds; strongly acid; abrupt wavy boundary.

IIB23t—31 to 35 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; weak coarse subangular blocky structure; very friable; about 30 percent fine gravel; many thin and moderately thick clay bridgings on sand grains and pebbles; strongly acid; abrupt wavy boundary.

IIB3—35 to 48 inches; yellowish brown (10YR 5/4) coarse sand; few lamellae of loamy sand 1 inch to 2 inches thick; single grained; loose; about 30 percent gravel; many thin clay bridgings on sand grains in the loamy sand part; strongly acid; clear wavy boundary.

IIC—48 to 60 inches; very pale brown (10YR 7/4) coarse sand; single grained; loose; about 5 percent gravel; neutral.

The thickness of the solum ranges from 36 to 55 inches. The depth to free carbonates ranges from 50 to 80 inches. Depth to the sandy material ranges from 24 to 40 inches. The mollic epipedon is 10 to 17 inches thick.

The A horizon typically is loam but in some pedons is silt loam. It is medium acid to neutral. It has value of 2 or 3 and chroma of 1 or 2. Some pedons have an A3 horizon, which is 2 to 5 inches thick. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is heavy loam, light clay loam, sandy clay loam, or sandy loam. The IIB horizon is gravelly loamy sand, coarse sand, loamy coarse sand, or loamy sand. The B and IIB horizons range from slightly acid to strongly acid. The IIC horizon is sand, coarse sand, or gravelly coarse sand.

Whalan series

The Whalan series consists of moderately deep, well drained, moderately permeable soils on summits on broad uplands. These soils formed in loamy and clayey glacial sediments over limestone bedrock. Slopes range from 1 to 12 percent.

Whalan soils are similar to Atkinson, Channahon, Rockton, and Waucoma soils. They commonly are adjacent to those soils, in similar positions on the landscape. Atkinson and Rockton soils have a mollic epipedon. Atkinson and Waucoma soils are deeper and Channahon soils shallower to bedrock than Whalan soils.

Typical pedon of Whalan loam, 1 to 6 percent slopes, 80 feet east and 420 feet north of the center of NE1/4 sec. 1, T. 104 N., R. 15 W.

A1—0 to 4 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; weak very fine subangular blocky structure; very friable; slightly acid; abrupt smooth boundary.

A2—4 to 8 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; weak very fine platy

structure; very friable; many very fine to medium tubular pores; medium acid; clear wavy boundary.

B1—8 to 17 inches; dark brown (10YR 4/3) loam; moderate medium subangular blocky structure; very friable; fine clean coatings of coarse silt and sand on faces of peds; many very fine to medium tubular pores; medium acid; clear wavy boundary.

B21t—17 to 22 inches; dark yellowish brown (10YR 4/4) clay loam; dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; friable; common fine clay films on faces of peds; many very fine to medium tubular pores; medium acid; clear wavy boundary.

IIB22t—22 to 27 inches; dark yellowish brown (10YR 4/4) clay; very dark grayish brown (10YR 3/2) coatings on faces of peds; strong medium angular blocky structure; firm; many medium clay films on faces of peds; about 7 percent fine gravel; common fine faint dark brown (10YR 4/3) mottles; mildly alkaline; abrupt wavy boundary.

IIR—27 inches; weathered bedrock; thin subhorizons and fracture fillings of very dark grayish brown (10YR 3/2) channery sandy clay loam; massive; mildly alkaline in the upper part.

The thickness of the solum, or the depth to limestone bedrock, ranges from 20 to 40 inches.

The A1 horizon typically is loam but in some pedons is silt loam. It has value of 2 or 3 and chroma 1 to 3. It is neutral or slightly acid. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is clay loam or loam and is strongly acid or medium acid. The IIB horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is neutral or mildly alkaline. It is clay, clay loam, or silty clay.

Zumbro series

The Zumbro series consists of deep, well drained, rapidly permeable soils that formed in sandy alluvium. These soils generally are on terraces above streams. Slopes are 0 to 2 percent.

Zumbro soils are similar to Bellechester and Minneiska soils and commonly are adjacent to Kalmarville and Plainfield soils. They are not underlain by the sandstone bedrock characteristic of Bellechester soils, and they contain more sand than Minneiska soils. Kalmarville soils are coarse-loamy. Plainfield soils lack a mollic epipedon.

Typical pedon of Zumbro loamy sand, 230 feet north and 165 feet east of the southwest corner of sec. 15, T. 108 N., R. 14 W.

A11—0 to 7 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; mildly alkaline; clear wavy boundary.

A12—7 to 25 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; single grained; loose; about 2 percent gravel; mildly alkaline; clear wavy boundary.

A3—25 to 48 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; single grained; loose; about 5 percent gravel; mildly alkaline; clear wavy boundary.

C—48 to 60 inches; grayish brown (10YR 5/2) sand; single grained; loose; about 5 percent gravel; mildly alkaline; slight effervescence.

The thickness of the solum ranges from 30 to 60 inches. The depth to free carbonates ranges from 20 to 50 inches. The content of gravel ranges from 0 to 20 percent in the solum and the C horizon. Reaction is mildly alkaline to slightly acid throughout the profile.

The A horizon ranges from 20 to 50 inches in thickness. It typically is loamy sand but in some pedons is loamy fine sand. It has value of 2 to 4 and chroma of 2 or 3. The C horizon has value of 4 or 5 and chroma of 2 to 5. It is sand or coarse sand.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*5*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status.

Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Hapludolls (*Hapl*, meaning simple horizons, plus *udoll*, the suborder of Mollisols that have a udic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups 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 is thought to typify the great group. An example is Typic Hapludolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, mesic Typic Hapludolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D-2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Minnesota Geological Survey. 1972. Geology of Minnesota. 623 pp., illus.

(4) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(5) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp. illus.

Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

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 coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they

cannot be shown separately on a soil map at the selected scale of mapping and publication.

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 (or contour farming). 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 40 or 80 inches (1 or 2 meters).

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. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects 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 for 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, as for example in "hillpeats" and "climatic moors."

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 running 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 a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. 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 an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered 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. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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. Inadequate strength for supporting 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 greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

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 mixed with mineral soil material. The content of organic matter is more than 20 percent.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree 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

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground 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. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

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.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that 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: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

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 that are separated from adjoining 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).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

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 or management.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature*						Precipitation*				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days**	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In	In	In
January	21.9	3.9	12.9	44	-29	0	0.95	0.38	1.39	2	8.7
February	26.4	7.4	16.9	49	-26	0	.76	.22	1.18	2	7.2
March	36.5	19.1	27.8	70	-12	0	1.47	.77	2.54	3	8.9
April	54.9	34.1	44.5	82	14	55	2.40	1.28	3.52	5	2.0
May	67.1	45.3	56.2	90	26	219	3.68	2.30	5.13	8	0.1
June	76.4	55.5	66.0	95	37	480	4.44	2.85	6.26	9	0.0
July	80.7	59.5	70.1	99	44	623	3.30	1.36	5.15	5	0.0
August	79.4	57.7	68.6	97	40	577	3.28	1.99	5.32	7	0.0
September	70.2	48.3	59.3	93	27	275	3.12	1.59	4.51	5	0.1
October	60.4	38.7	49.6	84	15	109	2.02	.93	2.93	4	0.8
November	40.9	24.2	32.6	69	7	0	1.55	.68	2.36	3	5.3
December	26.9	10.9	18.9	51	-21	0	.86	.39	1.37	2	7.6
Year	53.5	33.7	43.6	99	-30	2,338	27.83	23.68	32.40	55	40.6

* Based on records kept at Rochester and Grand Meadow, Minnesota, in the period 1888 to 1978.

** A growing degree day is a unit of heat available for plant growth. It can be calculated by subtracting from the average daily temperature the temperature below which growth is minimal for the principal crops in the area (50° F) and then multiplying the remainder by the number of days in the month.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

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 29	May 12	May 19
2 years in 10 later than--	April 21	May 7	May 14
5 years in 10 later than--	April 14	May 1	May 10
First freezing temperature in fall:			
1 year in 10 earlier than--	October 9	September 18	September 1
2 years in 10 earlier than--	October 15	September 26	September 11
5 years in 10 earlier than--	October 25	October 11	September 29

* Recorded in the period 1888 to 1978 at Rochester and Grand Meadow, Minnesota.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2A	Ostrander silt loam, 0 to 2 percent slopes	2,010	0.5
2B	Ostrander loam, 2 to 6 percent slopes	1,015	0.3
11C	Sogn loam, 4 to 12 percent slopes	1,835	0.4
16	Arenzville silt loam	5,860	1.4
19	Chaseburg silt loam	9,805	2.3
23	Skyberg silt loam	3,210	0.8
24	Kasson silt loam	7,315	1.7
25	Becker loam	3,695	0.9
27A	Dickinson sandy loam, 0 to 1 percent slopes	1,820	0.4
27B	Dickinson sandy loam, 2 to 6 percent slopes	1,145	0.3
27C	Dickinson sandy loam, 6 to 12 percent slopes	1,965	0.5
30B	Kenyon loam, 1 to 6 percent slopes	9,275	2.2
42E	Salida gravelly sandy loam, 12 to 35 percent slopes	1,645	0.4
73F	Bellechester loamy sand, 25 to 45 percent slopes	705	0.2
99B	Racine silt loam, 1 to 6 percent slopes	9,740	2.3
99C	Racine silt loam, 6 to 12 percent slopes	2,905	0.7
99D2	Racine loam, 12 to 18 percent slopes, eroded	695	0.2
131B	Massbach silt loam, 2 to 6 percent slopes	895	0.2
131C	Massbach silt loam, 6 to 12 percent slopes	1,060	0.3
131D	Massbach silt loam, 12 to 18 percent slopes	485	0.1
143B	Eleva sandy loam, 2 to 6 percent slopes	2,575	0.6
143C	Eleva sandy loam, 6 to 12 percent slopes	900	0.2
173F	Frontenac loam, 15 to 35 percent slopes	2,215	0.6
176	Garwin silty clay loam	10,570	2.5
203	Joy silt loam, 1 to 4 percent slopes	7,795	1.9
209A	Kegonsa silt loam, 0 to 2 percent slopes	1,260	0.3
209B	Kegonsa silt loam, 2 to 6 percent slopes	1,335	0.3
216B	Lamont sandy loam, 2 to 6 percent slopes	910	0.2
244C	Lilah sandy loam, 6 to 12 percent slopes	945	0.2
251F	Marlean silty clay loam, 25 to 40 percent slopes	7,595	1.8
251G	Marlean silty clay loam, 40 to 80 percent slopes	1,905	0.5
252	Marshan silt loam	880	0.2
283B	Plainfield loamy sand, 0 to 6 percent slopes	2,050	0.5
283C	Plainfield sand, 6 to 12 percent slopes	575	0.1
283E	Plainfield sand, 12 to 30 percent slopes	480	0.1
285A	Port Byron silt loam, 0 to 1 percent slopes	20,795	5.1
285B	Port Byron silt loam, 1 to 5 percent slopes	4,890	1.2
285C	Port Byron silt loam, 5 to 9 percent slopes	4,650	1.1
289	Radford silt loam	4,685	1.1
295	Readlyn loam	2,680	0.6
298	Richwood silt loam, 0 to 2 percent slopes	2,805	0.7
299A	Rockton loam, 0 to 1 percent slopes	7,145	1.7
299B	Rockton loam, 1 to 6 percent slopes	6,600	1.6
299C	Rockton loam, 6 to 12 percent slopes	1,380	0.3
301B	Lindstrom silt loam, 2 to 6 percent slopes	6,430	1.6
301C	Lindstrom silt loam, 6 to 15 percent slopes	1,405	0.4
309C	Schapville silty clay loam, 6 to 12 percent slopes	755	0.2
309D	Schapville silty clay loam, 12 to 25 percent slopes	275	0.1
312B	Shullsburg silt loam, 2 to 6 percent slopes	1,240	0.3
312C	Shullsburg silt loam, 6 to 12 percent slopes	2,070	0.5
313	Spillville silt loam	1,715	0.4
322C	Timula silt loam, 6 to 12 percent slopes	6,360	1.5
322D	Timula silt loam, 12 to 18 percent slopes	3,995	1.1
322E	Timula silt loam, 18 to 30 percent slopes	830	0.2
333	Vasa silt loam	1,135	0.3
340B	Whalan loam, 1 to 6 percent slopes	5,000	1.2
340C	Whalan loam, 6 to 12 percent slopes	2,970	0.7
369B	Waubeek silt loam, 1 to 6 percent slopes	3,995	1.1
369C	Waubeek silt loam, 6 to 12 percent slopes	2,320	0.7
378	Maxfield silty clay loam	9,560	2.3
401B	Mt. Carroll silt loam, 2 to 6 percent slopes	35,415	8.4
401C	Mt. Carroll silt loam, 6 to 12 percent slopes	13,025	3.1
401C2	Mt. Carroll silt loam, 6 to 12 percent slopes, eroded	14,475	3.6
401D	Mt. Carroll silt loam, 12 to 18 percent slopes	2,860	0.7
401D2	Mt. Carroll silt loam, 12 to 18 percent slopes, eroded	2,310	0.6
401E	Mt. Carroll silt loam, 18 to 25 percent slopes	840	0.2
463	Minneiska loam, occasionally flooded	500	0.1
465	Kalmarville silt loam	3,600	0.9
467	Sawmill silty clay loam	3,125	0.7
468	Otter silt loam, channeled	11,150	2.7
471	Root silt loam	2,380	0.6
472B	Channahon loam, 1 to 6 percent slopes	7,705	1.8

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
472C	Channahon loam, 6 to 12 percent slopes	7,105	1.7
473D	Dorerton loam, 12 to 25 percent slopes	4,005	1.0
473F	Dorerton loam, 25 to 40 percent slopes	2,710	0.6
474B	Haverhill clay, 1 to 8 percent slopes	1,125	0.3
475B	Backbone sandy loam, 1 to 6 percent slopes	1,400	0.3
476B	Frankville silt loam, 1 to 6 percent slopes	2,620	0.6
476C	Frankville silt loam, 6 to 12 percent slopes	4,790	1.1
477A	Littleton silt loam, 0 to 1 percent slopes	4,430	1.1
477B	Littleton silt loam, 1 to 4 percent slopes	4,310	1.0
478B	Coggon silt loam, 2 to 6 percent slopes	3,290	0.8
479	Floyd silt loam, 1 to 4 percent slopes	9,055	2.2
483A	Waukee loam, 0 to 2 percent slopes	5,435	1.3
483B	Waukee loam, 2 to 6 percent slopes	3,925	0.9
484C	Eyota sandy loam, 6 to 12 percent slopes	630	0.2
484E	Eyota loamy sand, 12 to 25 percent slopes	3,170	0.8
485	Lawler loam	1,715	0.4
486	Marshan silt loam, depressional	800	0.2
487	Hoopeston sandy loam	515	0.1
488F	Brodale flaggy loam, 25 to 40 percent slopes	2,695	0.6
488G	Brodale flaggy sandy loam, 40 to 80 percent slopes	1,455	0.3
489A	Atkinson loam, 0 to 1 percent slopes	3,120	0.7
489B	Atkinson loam, 1 to 6 percent slopes	3,840	0.9
491B	Waucoma loam, 2 to 6 percent slopes	2,175	0.5
492B	Nasset silt loam, 2 to 6 percent slopes	920	0.2
492C	Nasset silt loam, 6 to 12 percent slopes	840	0.2
493B	Oronoco loam, 2 to 6 percent slopes	1,455	0.3
493C	Oronoco loam, 6 to 12 percent slopes	1,405	0.3
493D	Oronoco fine sandy loam, 12 to 18 percent slopes	210	0.1
495	Zumbro loamy sand	535	0.1
516A	Dowagiac loam, 0 to 2 percent slopes	610	0.1
516B	Dowagiac silt loam, 2 to 6 percent slopes	1,715	0.4
516C	Dowagiac sandy loam, 6 to 12 percent slopes	2,050	0.5
528B	Palms muck, 1 to 6 percent slopes	665	0.2
593D	Elbaville silt loam, 12 to 18 percent slopes	3,955	0.9
593E	Elbaville silt loam, 18 to 30 percent slopes	2,095	0.5
898F	Brodale-Bellechester complex, 25 to 60 percent slopes	835	0.2
973D	Brodale-Sogn complex, 12 to 25 percent slopes	1,260	0.3
1013	Pits, quarry	300	0.1
1029	Pits, gravel	235	0.1
1039	Urban land	1,220	0.3
1078	Udorthents	440	0.1
1811B	Lamont-Racine complex, 2 to 6 percent slopes	2,425	0.6
1812B	Terril loam, sandy substratum, 1 to 6 percent slopes	3,240	0.8
1819G	Dorerton-Rock outcrop complex, very steep	565	0.1
1832C	Ostrander-Dowagiac loams, 6 to 12 percent slopes	1,510	0.4
1846	Kato silty clay loam, depressional	2,930	0.7
	Water areas less than 40 acres in size	1,420	0.3
	Total	419,290	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Soybeans	Oats	Grass-legume hay	Rotation pasture	Kentucky bluegrass
	Bu	Ton	Bu	Bu	Ton	AUM*	AUM*
2A---------- Ostrander	125	17	33	80	5.0	7.2	3.8
2B---------- Ostrander	120	17	33	78	4.8	6.7	3.3
11C---------- Sogn	---	---	---	---	---	1.5	1.1
16---------- Arenzville	135	20	40	87	5.0	7.4	4.0
19---------- Chaseburg	---	---	---	---	4.5	6.4	3.5
23---------- Skyberg	100	17	35	67	4.5	6.0	3.8
24---------- Kasson	100	14	33	67	3.8	5.5	3.6
25---------- Becker	80	12	30	60	4.0	5.8	2.3
27A---------- Dickinson	83	12	32	62	3.0	4.5	2.3
27B---------- Dickinson	81	11	31	60	3.0	4.5	2.0
27C---------- Dickinson	67	8	25	50	2.3	3.4	1.5
30B---------- Kenyon	120	16	36	79	4.7	6.8	3.3
42E---------- Salida	---	---	---	---	---	1.5	0.6
73F---------- Bellechester	---	---	---	---	---	1.0	0.6
99B---------- Racine	110	15	33	77	4.4	6.3	3.3
99C---------- Racine	95	14	28	75	3.8	5.9	3.0
99D2---------- Racine	85	12	26	70	3.6	5.2	3.0
131B---------- Massbach	86	13	32	62	3.6	5.2	3.5
131C---------- Massbach	77	12	30	58	3.0	4.5	2.8
131D---------- Massbach	72	10	28	53	2.9	4.5	2.5
143B---------- Eleva	75	12	25	53	3.0	4.5	2.0
143C---------- Eleva	65	8	20	49	2.6	4.0	1.5

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Soybeans	Oats	Grass-legume hay	Rotation pasture	Kentucky bluegrass
	Bu	Ton	Bu	Bu	Ton	AUM*	AUM*
173F---------- Frontenac	---	---	---	---	---	1.0	0.8
176---------- Garwin	130	18	40	86	5.0	7.5	8.8
203---------- Joy	135	20	40	87	5.0	7.5	4.1
209A---------- Kegonsa	90	13	27	64	3.7	4.3	3.8
209B---------- Kegonsa	85	12	25	62	3.4	5.2	3.7
216B---------- Lamont	80	10	26	56	3.2	4.8	3.6
244C---------- Lilah	52	7	18	34	2.0	3.0	0.9
251F, 251G---------- Marlean	---	---	---	---	---	1.2	1.0
252---------- Marshan	95	14	35	70	4.0	6.0	3.9
283B---------- Plainfield	45	6	16	32	2.0	1.3	1.0
283C---------- Plainfield	---	---	---	---	---	0.9	0.7
283E---------- Plainfield	---	---	---	---	---	0.7	0.5
285A---------- Port Byron	135	20	42	86	5.1	7.5	4.1
285B---------- Port Byron	130	19	41	83	5.1	7.5	3.6
285C---------- Port Byron	110	16	32	72	4.2	6.8	3.3
289---------- Radford	128	17	37	82	4.8	7.2	4.1
295---------- Readlyn	125	16	35	79	4.8	7.2	3.8
298---------- Richwood	135	21	42	86	5.0	7.5	3.8
299A---------- Rockton	95	14	28	70	4.0	6.0	3.8
299B---------- Rockton	90	13	26	65	3.4	5.6	3.7
299C---------- Rockton	75	9	22	57	3.2	4.9	3.5
301B---------- Lindstrom	130	18	35	80	4.7	7.2	3.8
301C---------- Lindstrom	110	15	30	70	4.5	6.5	3.5

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Soybeans	Oats	Grass-legume hay	Rotation pasture	Kentucky bluegrass
	Bu	Ton	Bu	Bu	Ton	AUM*	AUM*
309C---------- Schapville	76	11	28	56	3.1	5.0	2.0
309D---------- Schapville	---	---	---	---	---	---	1.0
312B---------- Shullsburg	90	13	32	65	3.6	5.2	3.6
312C---------- Shullsburg	80	12	30	55	3.2	4.8	3.5
313---------- Spillville	135	19	39	87	5.1	7.5	3.8
322C---------- Timula	90	14	30	67	3.6	5.2	2.0
322D---------- Timula	80	12	27	63	3.2	4.8	2.0
322E---------- Timula	---	---	---	---	---	1.7	1.5
333---------- Vasa	135	20	35	86	5.0	7.2	3.9
340B---------- Whalan	80	12	24	60	3.3	4.8	3.3
340C---------- Whalan	70	10	21	53	3.1	4.6	2.7
369B---------- Waubeek	125	17	34	81	4.7	6.8	3.3
369C---------- Waubeek	110	15	30	72	4.2	6.2	3.0
378---------- Maxfield	130	18	37	82	5.0	7.4	3.8
401B---------- Mt. Carroll	130	19	39	82	4.8	7.0	3.3
401C, 401C2---------- Mt. Carroll	115	16	31	76	4.3	6.2	2.8
401D---------- Mt. Carroll	95	14	28	63	3.6	5.2	2.6
401D2---------- Mt. Carroll	90	14	26	62	3.7	5.0	2.6
401E---------- Mt. Carroll	---	---	---	---	---	---	2.5
463---------- Minneiska	135	20	40	86	4.9	7.0	4.0
465---------- Kalmarville	---	---	---	---	---	4.1	3.8
467---------- Sawmill	125	17	41	81	4.9	7.2	4.0
468---------- Otter	---	---	---	---	---	3.3	3.0
471---------- Root	---	---	---	---	---	3.3	3.0

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Soybeans	Oats	Grass-legume hay	Rotation pasture	Kentucky bluegrass
	Bu	Ton	Bu	Bu	Ton	AUM*	AUM*
472B--Channahon	65	9	23	45	2.8	4.4	3.4
472C--Channahon	55	7	19	37	2.5	3.7	3.0
473D--Dorerton	---	---	---	---	---	2.7	2.5
473F--Dorerton	---	---	---	---	---	2.5	2.0
474B--Haverhill	---	---	---	---	---	3.5	3.3
475B--Backbone	70	11	21	49	2.7	4.5	2.3
476B--Frankville	95	15	30	70	3.8	5.9	3.3
476C--Frankville	90	13	28	65	3.8	5.9	3.0
477A--Littleton	133	19	42	85	5.0	7.2	4.0
477B--Littleton	128	18	39	82	4.8	7.2	4.1
478B--Coggon	101	17	38	80	4.7	7.1	3.3
479--Floyd	125	18	40	85	4.8	7.5	4.1
483A--Waukee	89	14	30	64	3.7	5.5	3.3
483B--Waukee	86	13	28	61	3.5	5.2	3.1
484C--Eyota	110	15	30	75	4.0	6.0	2.5
484E--Eyota	---	---	---	---	---	1.2	1.0
485--Lawler	95	15	32	65	4.2	6.3	4.0
486--Marshan	85	12	31	63	4.0	6.0	3.3
487--Hoopeston	91	14	30	64	3.7	5.9	3.0
488F, 488G--Brodale	---	---	---	---	---	0.8	0.6
489A--Atkinson	120	17	37	78	4.6	6.7	3.8
489B--Atkinson	110	15	35	74	4.4	6.5	3.5
491B--Waucoma	115	16	37	78	4.5	6.3	3.3
492B--Nasset	104	13	30	68	4.4	5.8	3.3

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Soybeans	Oats	Grass-legume hay	Rotation pasture	Kentucky bluegrass
	Bu	Ton	Bu	Bu	Ton	AUM*	AUM*
492C---------- Nasset	95	12	28	66	4.0	5.8	2.6
493B---------- Oronoco	115	14	35	80	5.0	7.2	3.0
493C---------- Oronoco	110	14	33	75	4.5	6.7	2.6
493D---------- Oronoco	90	11	24	68	4.0	6.0	2.5
495---------- Zumbro	55	7	16	41	2.2	3.3	1.5
516A---------- Dowagiac	78	12	30	61	3.0	4.5	3.3
516B---------- Dowagiac	75	11	30	59	3.0	4.5	3.2
516C---------- Dowagiac	65	8	27	52	2.3	3.3	1.5
528B---------- Palms	---	---	---	---	---	---	2.0
593D---------- Elbaville	65	7	27	50	2.4	3.7	3.0
593E---------- Elbaville	---	---	---	---	---	1.0	2.5
898F---------- Brodale-Bellechester	---	---	---	---	---	1.0	0.7
973D---------- Brodale-Sogn	---	---	---	---	---	1.0	0.6
1811B---------- Lamont-Racine	95	12	29	71	3.5	5.4	2.0
1812B---------- Terril	118	16	34	87	4.4	6.5	3.7
1819G---------- Dorerton-Rock outcrop	---	---	---	---	---	0.9	0.7
1832C---------- Ostrander-Dowagiac	89	14	30	73	4.0	5.6	3.1
1846---------- Kato	110	14	35	70	4.5	6.7	3.5

* 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 5.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	36,975	---	---	---
II	196,137	118,962	45,950	31,225
III	74,401	63,451	6,940	4,010
IV	20,240	16,790	---	3,450
V	27,600	---	27,600	---
VI	16,170	10,355	1,125	4,690
VII	25,334	14,425	---	10,909
VIII	---	---	---	---

TABLE 6.--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				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
16---------- Arenzville	2o	Slight	Slight	Slight	Slight	Northern red oak---- Bur oak---------- Silver maple---------	65 --- ---	Red pine, eastern white pine, white spruce, northern red oak.
19---------- Chaseburg	2o	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- American basswood---	65 --- ---	Red pine, eastern white pine, white spruce, northern red oak.
23---------- Skyberg	2o	Slight	Slight	Slight	Slight	American basswood--- Silver maple-------- Eastern cottonwood-- Sugar maple---------	60 60 86 60	Silver maple, eastern cottonwood, American basswood, eastern white pine.
24---------- Kasson	2o	Slight	Slight	Slight	Slight	Eastern cottonwood-- American basswood--- Sugar maple--------- Black walnut--------	85 70 60 55	Black walnut, eastern cottonwood, American basswood, eastern white pine.
99B, 99C---------- Racine	2o	Slight	Slight	Slight	Slight	American basswood--- Northern red oak---- Black walnut-------- Sugar maple---------	68 65 60 60	White spruce, eastern white pine, black walnut, green ash, northern red oak.
99D2---------- Racine	2r	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, northern red oak.
131B, 131C, 131D--- Massbach	2o	Slight	Slight	Slight	Slight	White oak---------- Northern red oak----	70 ---	White oak, Scotch pine, white ash, eastern white pine, red pine, northern red oak.
143B, 143C--------- Eleva	4o	Slight	Slight	Slight	Slight	Northern pin oak---- Jack pine---------- Black oak---------- Northern red oak----	--- 45 --- ---	Jack pine, red pine.
173F---------- Frontenac	3r	Moderate	Moderate	Moderate	Slight	Northern red oak---- Quaking aspen------- Butternut---------- American basswood--- White oak----------	60 56 55 60 60	Eastern white pine, red pine, black walnut, northern red oak, American basswood.
209A, 209B--------- Kegonsa	2o	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- American basswood--- White ash----------	65 --- --- ---	Red pine, eastern white pine, white spruce, northern red oak, white oak.
216B---------- Lamont	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------	55 55	Eastern white pine, Scotch pine, northern red oak, white oak.
244C---------- Lilah	3s	Slight	Slight	Severe	Slight	Northern red oak----	55	Eastern white pine, Scotch pine, northern red oak.
251F, 251G--------- Marlean	3r	Severe	Severe	Moderate	Moderate	Northern red oak---- American basswood--- Green ash---------- White oak---------- Quaking aspen-------	55 55 52 52 ---	Northern red oak, American basswood, eastern white pine, black walut, red pine.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
283B, 283C--------- Plainfield	3s	Slight	Slight	Severe	Slight	Red pine---------- Eastern white pine-- Jack pine---------- Northern pin oak----	55 --- --- ---	Red pine, eastern white pine, jack pine.
283E--------- Plainfield	3s	Moderate	Severe	Severe	Slight	Red pine---------- Eastern white pine-- Jack pine---------- Northern pin oak----	55 --- --- ---	Red pine, eastern white pine, jack pine.
322C--------- Timula	2o	Slight	Slight	Slight	Slight	White oak---------- Northern red oak---- Green ash---------- Bur oak----------	70 65 65 65	Eastern white pine, red pine, Scotch pine, black walnut, northern red oak, white oak.
322D, 322E--------- Timula	3r	Moderate	Moderate	Moderate	Slight	White oak---------- Northern red oak---- Green ash---------- Bur oak----------	70 65 65 65	Eastern white pine, red pine, Scotch pine, black walnut, northern red oak, white oak.
333--------- Vasa	2o	Slight	Slight	Slight	Slight	Northern red oak---- American basswood--- Black walnut-------- Quaking aspen-------	65 70 60 75	Northern red oak, American basswood, black walnut, white spruce, common hackberry, eastern white pine.
340B, 340C--------- Whalan	2o	Slight	Slight	Slight	Slight	Eastern white pine-- Northern red oak---- White oak---------- Black walnut--------	58 60 60 55	Northern red oak, white oak, silver maple, eastern white pine.
369B, 369C--------- Waubeek	2o	Slight	Slight	Slight	Slight	White oak---------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, black walnut, sugar maple.
401B, 401C, 401C2-- Mt. Carroll	2o	Slight	Slight	Slight	Slight	Northern red oak---- American basswood--- Sugar maple---------	70 --- ---	Black walnut, eastern white pine, red pine, northern red oak, white oak.
401D, 401D2, 401E-- Mt. Carroll	2r	Moderate	Moderate	Moderate	Slight	Northern red oak---- American basswood--- Sugar maple---------	70 --- ---	Black walnut, eastern white pine, red pine, northern red oak, white oak.
463--------- Minneiska	2o	Slight	Slight	Slight	Slight	Eastern cottonwood--	100	Black walnut, green ash, white oak, silver maple.
465--------- Kalmarville	3w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Silver maple-------- Green ash---------- American basswood---	90 60 60 80	Silver maple, eastern cottonwood, green ash, white spruce, American basswood.
468--------- Otter	2w	Slight	Severe	Moderate	Moderate	Silver maple--------	94	Black spruce, green ash, pin oak, silver maple, eastern cottonwood.
471--------- Root	3w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Silver maple-------- Green ash---------- American basswood---	90 60 60 80	Silver maple, eastern cottonwood, green ash, white spruce, American basswood.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
473D, 473F--------- Dorerton	3f	Slight	Moderate	Slight	Slight	Northern red oak---- Eastern white pine-- White oak---------- Bur oak---------- American basswood--- Black cherry-------- Quaking aspen--------	55 50 50 50 50 50 60	Northern red oak, eastern white pine, white spruce, black walnut.
475B--------------- Backbone	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------	55 55	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, black walnut, sugar maple.
476B, 476C--------- Frankville	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------	65 65	Eastern white pine, red pine, Scotch pine, Norway spruce, black walnut, sugar maple.
478B--------------- Coggon	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, black walnut, sugar maple.
491B--------------- Waucoma	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, black walnut, sugar maple.
492B, 492C--------- Nasset	2o	Slight	Slight	Slight	Slight	White oak---------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, black walnut, sugar maple.
493B, 493C--------- Oronoco	2o	Slight	Slight	Slight	Slight	Black walnut-------- American basswood--- Northern red oak---- White oak---------- Eastern white pine--	60 70 70 65 65	Black walnut, northern red oak, white oak, eastern white pine, American basswood, white spruce.
493D--------------- Oronoco	2r	Moderate	Slight	Slight	Slight	Black walnut-------- American basswood--- Northern red oak---- White oak---------- Eastern white pine--	60 70 70 65 65	Black walnut, northern red oak, white oak, eastern white pine, American basswood, white spruce.
516A, 516B, 516C--- Dowagiac	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak---------- White ash---------- Black walnut-------- Black cherry-------- Yellow-poplar------- Sugar maple--------- American basswood---	65 --- 61 --- --- --- 61 61	Black walnut, sugar maple, northern red oak, eastern white pine, red pine, white spruce.
593D, 593E--------- Elbaville	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak---------- American basswood--- Sugar maple--------- Butternut---------- Black walnut-------- Paper birch---------	65 55 65 65 65 65 ---	Northern red oak, black walnut, eastern white pine.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
1811B*:								
Lamont	3o	Slight	Slight	Slight	Slight	Northern red oak	55	Eastern white pine, Scotch pine, European larch, northern red oak.
						White oak	55	
Racine	2o	Slight	Slight	Slight	Slight	American basswood	68	White spruce, eastern white pine, black walnut, green ash, northern red oak.
						Northern red oak	65	
						Black walnut	60	
						Sugar maple	60	
1819G*:								
Dorerton	3f	Moderate	Severe	Moderate	Slight	Northern red oak	55	Northern red oak, eastern white pine, white spruce, black walnut.
						Eastern white pine	50	
						White oak	50	
						Bur oak	50	
						American basswood	50	
						Black cherry	50	
						Quaking aspen	60	
Rock outcrop.								
1832C*:								
Ostrander.								
Dowagiac	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Black walnut, sugar maple, northern red oak, eastern white pine, red pine, white spruce.
						White oak	---	
						White ash	61	
						Black walnut	---	
						Black cherry	---	
						Yellow-poplar	---	
						Sugar maple	61	
						American basswood	61	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Only the soils suited to trees grown as windbreaks or environmental plantings are listed. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
2A, 2B---------- Ostrander	Gray dogwood, Tatarian honeysuckle, lilac.	Siberian crabapple, Amur maple, eastern redcedar, northern white-cedar.	Eastern white pine, green ash, common hackberry.	Eastern cottonwood, silver maple.
16---------- Arenzville	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, green ash, common hackberry.	Eastern cottonwood, silver maple.
19---------- Chaseburg	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, green ash, common hackberry.	Eastern cottonwood, silver maple.
23---------- Skyberg	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple.	Eastern white pine, green ash, common hackberry.	Eastern cottonwood, silver maple.
24---------- Kasson	Gray dogwood, Tatarian honeysuckle, lilac.	White spruce, northern white-cedar, Siberian crabapple, Amur maple.	Green ash, eastern white pine, common hackberry, red pine.	Silver maple.
25---------- Becker	Gray dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, red pine, green ash.	Eastern cottonwood, silver maple.
27A, 27B, 27C----- Dickinson	Siberian peashrub, Tatarian honeysuckle, Siberian crabapple, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, ponderosa pine, Scotch pine.	Green ash----------	---
30B---------- Kenyon	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
99B, 99C---------- Racine	Tatarian honeysuckle, lilac.	Eastern redcedar, northern white-cedar, blue spruce, Siberian crabapple, Amur maple.	Eastern white pine, green ash, common hackberry, bur oak.	Silver maple.
131B, 131C, 131D-- Massbach	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
143B, 143C-------- Eleva	Siberian peashrub, lilac, Siberian crabapple, Tatarian honeysuckle.	Eastern white pine, red pine, jack pine, Norway spruce, eastern redcedar, northern white-cedar.	Green ash----------	---

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
176---------- Garwin	Northern white-cedar, redosier dogwood, medium purple willow, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
203---------- Joy	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
209A, 209B--------- Kegonsa	Silky dogwood, common ninebark, lilac, Tatarian honeysuckle, silver buffaloberry.	White spruce, northern white-cedar, Norway spruce.	Eastern white pine, red pine, common hackberry, green ash.	---
216B---------- Lamont	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, ponderosa pine, Scotch pine.	Green ash----------	---
244C---------- Lilah	Eastern redcedar, northern white-cedar, Russian-olive, Siberian crabapple, silver buffaloberry, Tatarian honeysuckle, Siberian peashrub.	Bur oak, ponderosa pine, jack pine, green ash, common hackberry.	---	---
252---------- Marshan	Redosier dogwood, northern white-cedar, medium purple willow, Tatarian honeysuckle.	Eastern white pine, Siberian crabapple, Amur maple, white spruce.	Golden willow, silver maple, green ash.	Eastern cottonwood.
283B, 283C--------- Plainfield	Siberian peashrub, lilac, eastern redcedar, Tatarian honeysuckle, silver buffaloberry, northern white-cedar.	Eastern white pine, red pine, jack pine, Norway spruce, common hackberry.	---	---
285A, 285B, 285C-- Port Byron	Tatarian honeysuckle, lilac.	Northern white-cedar, Siberian crabapple, Amur maple, white spruce.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
289---------- Radford	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
295---------- Readlyn	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
298---------- Richwood	Lilac, common ninebark, silky dogwood.	White spruce, Norway spruce, northern white-cedar, Siberian crabapple, Amur maple.	Eastern white pine, red pine, common hackberry.	---

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
299A, 299B, 299C--Rockton	Siberian crabapple, gray dogwood, Tatarian honeysuckle, lilac.	Eastern redcedar, northern white-cedar, blue spruce, eastern white pine, common hackberry.	Green ash	---
301B, 301C--Lindstrom	Redosier dogwood, Tatarian honeysuckle, lilac.	Eastern redcedar, northern white-cedar, blue spruce, Siberian crabapple, Amur maple.	Eastern white pine, green ash, common hackberry.	Eastern cottonwood.
309C--Schapville	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, ponderosa pine, Scotch pine.	Green ash	---
312B, 312C--Shullsburg	Tatarian honeysuckle, lilac.	White spruce, northern white-cedar, Siberian crabapple, Amur maple, medium purple willow.	Eastern white pine, ponderosa pine, common hackberry, green ash.	Silver maple.
313--Spillville	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
322C, 322D--Timula	Tatarian honeysuckle, lilac.	Northern white-cedar, Siberian crabapple, Amur maple, white spruce.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
333--Vasa	Gray dogwood, Tatarian honeysuckle, lilac.	Eastern redcedar, northern white-cedar, blue spruce, Siberian crabapple, Amur maple.	Eastern white pine, green ash, common hackberry.	Eastern cottonwood.
340B, 340C--Whalan	Siberian crabapple, gray dogwood, Tatarian honeysuckle, lilac.	Eastern redcedar, eastern white pine, white spruce, red pine, common hackberry.	Green ash	Eastern cottonwood.
369B, 369C--Waubeek	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
378--Maxfield	Northern white-cedar, redosier dogwood, medium purple willow, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
401B, 401C, 401C2 Mt. Carroll	Peking cotoneaster, gray dogwood, silky dogwood, lilac, Amur maple, mockorange.	Northern white-cedar	White spruce, red pine	Eastern white pine.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
463---------- Minneiska	Tatarian honeysuckle	Northern white-cedar, purpleosier willow, white spruce, blue spruce, Siberian crabapple.	Common hackberry, bur oak, green ash.	Eastern cottonwood, silver maple.
467---------- Sawmill	Northern white-cedar, tall purple willow, Tatarian honeysuckle.	White spruce----------	Golden willow---------	Eastern cottonwood.
475B---------- Backbone	Eastern redcedar, northern white-cedar, Russian-olive, Siberian crabapple, silver buffaloberry, Tatarian honeysuckle, Siberian peashrub.	Bur oak, ponderosa pine, jack pine, green ash, common hackberry.	---	---
476B, 476C-------- Frankville	White spruce, Tatarian honeysuckle, lilac.	Northern white-cedar, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
477A, 477B-------- Littleton	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
478B---------- Coggon	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
479---------- Floyd	Northern white-cedar, redosier dogwood, medium purple willow, Tatarian honeysuckle.	Siberian crabapple, Amur maple, eastern white pine, white spruce.	Silver maple, golden willow, green ash.	Eastern cottonwood.
483A, 483B-------- Waukee	Tatarian honeysuckle, bloodtwig dogwood, Siberian crabapple.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
484C---------- Eyota	Silver buffaloberry, Siberian crabapple, lilac, redosier dogwood.	Eastern redcedar, red pine, bur oak, blue spruce, eastern white pine, common hackberry. Russian-olive.	Green ash----------	---
485---------- Lawler	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, ponderosa pine, Scotch pine.	Green ash----------	---
486---------- Marshan	Redosier dogwood, northern white-cedar, medium purple willow, Tatarian honeysuckle.	Eastern white pine, Siberian crabapple, Amur maple, white spruce.	Golden willow, silver maple, green ash.	Eastern cottonwood.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
487---------- Hoopeston	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, ponderosa pine, Scotch pine.	Green ash----------	---
489A, 489B-------- Atkinson	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
491B---------- Waucoma	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
492B, 492C-------- Nasset	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
493B, 493C-------- Oronoco	Redosier dogwood, Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Bur oak, green ash, eastern white pine, common hackberry.	Silver maple.
495---------- Zumbro	Eastern redcedar, Russian-olive, silver buffaloberry, Siberian crabapple, Tatarian honeysuckle, Peking cotoneaster.	Common hackberry, white spruce, bur oak, eastern white pine, green ash.	---	---
516A, 516B, 516C-- Dowagiac	Late lilac, Amur privet, autumn-olive.	Northern white-cedar, red pine, white spruce, common hackberry.	Eastern white pine, Norway spruce, green ash, bur oak.	---
1811B*: Lamont----------	Siberian crabapple, Tatarian honeysuckle, Siberian peashrub, lilac.	Eastern redcedar, common hackberry, northern white-cedar, bur oak, white spruce, ponderosa pine, Scotch pine.	Green ash----------	---
Racine----------	Tatarian honeysuckle, lilac.	Eastern redcedar, northern white-cedar, blue spruce, Siberian crabapple, Amur maple.	Eastern white pine, green ash, common hackberry, bur oak.	Silver maple.
1812B---------- Terril	Tatarian honeysuckle, lilac.	Northern white-cedar, white spruce, Siberian crabapple, Amur maple.	Common hackberry, bur oak, eastern white pine, ponderosa pine, green ash.	Silver maple.
1832C*: Ostrander--------	Gray dogwood, Tatarian honeysuckle, lilac.	Siberian crabapple, Amur maple, eastern redcedar, northern white-cedar.	Eastern white pine, green ash, common hackberry.	Eastern cottonwood, silver maple.
Dowagiac---------	Late lilac, Amur privet, autumn-olive.	Northern white-cedar, red pine, white spruce.	Eastern white pine, Norway spruce.	---

*See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
1846---------- Kato	Northern white-cedar	Russian-olive, black spruce, Amur maple, blue spruce.	Common hackberry, black ash, green ash, American elm.	Siberian elm, eastern cottonwood.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2A Ostrander	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
2B Ostrander	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
11C Sogn	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: thin layer.
16 Arenzville	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.	Severe: floods.
19 Chaseburg	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
23 Skyberg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength, wetness.	Moderate: wetness.
24 Kasson	Moderate: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: frost action, low strength.	Slight.
25 Becker	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, frost action, low strength.	Slight.
27A Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
27B Dickinson	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
27C Dickinson	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
30B Kenyon	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
42E Salida	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
73F Bellechester	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
99B Racine	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.	Slight.
99C Racine	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope.
99D2 Racine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 8.--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
131B---------- Massbach	Moderate: wetness.	Moderate: shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
131C---------- Massbach	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
131D---------- Massbach	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength.	Severe: slope.
143B, 143C-------- Eleva	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
173F---------- Frontenac	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Severe: slope.	Severe: slope.
176---------- Garwin	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength.	Moderate: wetness.
203---------- Joy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, low strength.	Slight.
209A---------- Kegonsa	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
209B---------- Kegonsa	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
216B---------- Lamont	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
244C---------- Lilah	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
251F, 251G-------- Marlean	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
252---------- Marshan	Severe: wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: frost action, low strength.	Moderate: wetness.
283B---------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: too sandy.
283C---------- Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: too sandy, slope.
283E---------- Plainfield	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
285A, 285B-------- Port Byron	Slight---------	Slight---------	Slight---------	Slight---------	Severe: frost action, low strength.	Slight.
285C---------- Port Byron	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: frost action, low strength.	Slight.

TABLE 8.--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
289--- Radford	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, frost action, floods.	Moderate: wetness, floods.
295--- Readlyn	Severe: wetness.	Moderate: wetness, low strength.	Severe: wetness.	Moderate: wetness, low strength.	Severe: frost action, low strength.	Slight.
298--- Richwood	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.	Slight.
299A--- Rockton	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: thin layer.
299B--- Rockton	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Moderate: thin layer.
299C--- Rockton	Moderate: depth to rock, slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
301B--- Lindstrom	Slight---	Slight---	Slight---	Moderate: slope.	Severe: frost action.	Slight.
301C--- Lindstrom	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
309C--- Schapville	Moderate: slope, depth to rock.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
309D--- Schapville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: floods.
312B--- Shullsburg	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: thin layer.
312C--- Shullsburg	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: slope, thin layer.
313--- Spillville	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
322C--- Timula	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
322D, 322E--- Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope.	Severe: slope.
333--- Vasa	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
340B--- Whalan	Moderate: depth to rock.	Slight---	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength, frost action.	Moderate: thin layer.
340C--- Whalan	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, low strength, frost action.	Moderate: slope, thin layer.

TABLE 8.--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
369B---------- Waubeek	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
369C---------- Waubeek	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
378---------- Maxfield	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, frost action, low strength.	Moderate: wetness.
401B---------- Mt. Carroll	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: frost action, low strength.	Slight.
401C, 401C2------- Mt. Carroll	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
401D, 401D2, 401E- Mt. Carroll	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
463---------- Minneiska	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
465---------- Kalmarville	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: wetness, floods.
467---------- Sawmill	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.	Severe: wetness, floods.
468---------- Otter	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, low strength.	Severe: wetness.
471---------- Root	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: wetness, floods.
472B---------- Channahon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
472C---------- Channahon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: thin layer.
473D, 473F-------- Dorerton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
474B---------- Haverhill	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, frost action, low strength.	Severe: wetness, too clayey.
475B---------- Backbone	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock.	Moderate: thin layer.

TABLE 8.--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
476B--- Frankville	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: low strength, frost action.	Moderate: thin layer.
476C--- Frankville	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: depth to rock.	Severe: slope.	Severe: low strength, frost action.	Moderate: thin layer, slope.
477A--- Littleton	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: frost action.	Slight.
477B--- Littleton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Slight.
478B--- Coggon	Slight---	Slight---	Slight---	Moderate: slope.	Severe: low strength.	Slight.
479--- Floyd	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action, low strength.	Slight.
483A--- Waukee	Severe: cutbanks cave.	Slight---	Slight---	Slight---	Moderate: low strength.	Slight.
483B--- Waukee	Severe: cutbanks cave.	Slight---	Slight---	Moderate: slope.	Moderate: low strength.	Slight.
484C--- Eyota	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, frost action, slope.	Moderate: slope.
484E--- Eyota	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
485--- Lawler	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, low strength.	Slight.
486--- Marshan	Severe: wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action, low strength.	Severe: floods, wetness.
487--- Hoopeston	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
488F, 488G--- Brodale	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
489A--- Atkinson	Moderate: depth to rock.	Slight---	Moderate: depth to rock.	Slight---	Severe: low strength.	Slight.
489B--- Atkinson	Moderate: depth to rock.	Slight---	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.	Slight.
491B--- Waucoma	Moderate: depth to rock.	Slight---	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.	Slight.
492B--- Nasset	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength, frost action.	Slight.
492C--- Nasset	Moderate: slope, depth to rock.	Moderate: slope, shrink-swell.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.

TABLE 8.--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
493B---------- Oronoco	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
493C---------- Oronoco	Moderate: slope.	Moderate: slope.	Moderate: slope.	Moderate: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
493D---------- Oronoco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
495---------- Zumbro	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Slight.
516A---------- Dowagiac	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action, low strength.	Slight.
516B---------- Dowagiac	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action, low strength.	Slight.
516C---------- Dowagiac	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope, low strength.	Moderate: slope.
528B---------- Palms	Severe: wetness, excess humus.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, excess humus.
593D, 593E-------- Elbaville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
898F*: Brodale----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bellechester-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
973D*: Brodale----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sogn----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: thin layer.
1013*. Pits						
1029*. Pits						
1039*. Urban land						
1078*. Udorthents						
1811B*: Lamont----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.

See footnote at end of table.

TABLE 8.--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
1811B*: Racine	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.	Slight.
1812B Terril	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
1819G*: Dorerton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
1832C*: Ostrander	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.	Moderate: slope.
Dowagiac	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope, low strength.	Moderate: slope.
1846 Kato	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2A Ostrander	Slight	Moderate: seepage.	Slight	Slight	Good.
2B Ostrander	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
11C Sogn	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
16 Arenzville	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
19 Chaseburg	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
23 Skyberg	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
24 Kasson	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
25 Becker	Severe: poor filter.	Severe: floods, seepage.	Severe: seepage, wetness.	Severe: seepage.	Poor: too sandy, seepage.
27A, 27B Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
27C Dickinson	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
30B Kenyon	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
42E Salida	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, seepage, small stones.
73F Bellechester	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope, depth to rock.	Severe: seepage, slope.	Poor: too sandy, seepage, slope.
99B Racine	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
99C Racine	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
99D2 Racine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
131B Massbach	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Fair: too clayey.

TABLE 9.--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
131C---------- Massbach	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: slope, depth to rock.	Fair: slope, too clayey.
131D---------- Massbach	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
143B, 143C---------- Eleva	Severe: depth to rock, poor filter.	Severe: seepage.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.
173F---------- Frontenac	Severe: slope.	Severe: slope, seepage.	Severe: seepage, slope.	Severe: slope, seepage.	Poor: slope.
176---------- Garwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
203---------- Joy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
209A, 209B---------- Kegonsa	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
216B---------- Lamont	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
244C---------- Lilah	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Fair: slope, too sandy.
251F, 251G---------- Marlean	Severe: slope, depth to rock.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage, depth to rock.	Poor: slope, depth to rock, small stones.
252---------- Marshan	Severe: wetness, poor filter.	Severe: wetness, floods, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: wetness, too sandy, seepage.
283B---------- Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
283C---------- Plainfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
283E---------- Plainfield	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
285A---------- Port Byron	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Good.
285B---------- Port Byron	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Good.
285C---------- Port Byron	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
289---------- Radford	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.

TABLE 9.--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
295---------- Readlyn	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
298---------- Richwood	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
299A, 299B---------- Rockton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
299C---------- Rockton	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
301B---------- Lindstrom	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Good.
301C---------- Lindstrom	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
309C---------- Schapville	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey.
309D---------- Schapville	Severe: percs slowly, slope, depth to rock.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope, depth to rock.	Poor: slope, area reclaim, too clayey.
312B---------- Shullsburg	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness, too clayey.	Severe: wetness, depth to rock.	Poor: area reclaim, wetness, too clayey.
312C---------- Shullsburg	Severe: depth to rock, wetness, percs slowly.	Severe: slope, depth to rock, wetness.	Severe: depth to rock, wetness, too clayey.	Severe: wetness, depth to rock.	Poor: area reclaim, wetness, too clayey.
313---------- Spillville	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Fair: wetness.
322C---------- Timula	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
322D, 322E---------- Timula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
333---------- Vasa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
340B---------- Whalan	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
340C---------- Whalan	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
369B---------- Waubeek	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Good.
369C---------- Waubeek	Moderate: slope.	Severe----------	Slight----------	Moderate: slope.	Fair: slope.
378---------- Maxfield	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

TABLE 9.--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
401B---------- Mt. Carroll	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Good.
401C, 401C2--------- Mt. Carroll	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
401D, 401D2, 401E--- Mt. Carroll	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
463---------- Minneiska	Severe: floods, wetness, poor filter.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: wetness.
465---------- Kalmarville	Severe: floods, wetness, poor filter.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness.
467---------- Sawmill	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
468---------- Otter	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
471---------- Root	Severe: floods, wetness, poor filter.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness, large stones.
472B---------- Channahon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
472C---------- Channahon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
473D, 473F---------- Dorerton	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
474B---------- Haverhill	Severe: wetness, depth to rock, percs slowly.	Severe: wetness.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
475B---------- Backbone	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.
476B---------- Frankville	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
476C---------- Frankville	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
477A, 477B---------- Littleton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
478B---------- Coggon	Severe: percs slowly.	Moderate: slope.	Slight----------	Slight----------	Good.

TABLE 9.--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
479---------- Floyd	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
483A, 483B---------- Waukee	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
484C---------- Eyota	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope.
484E---------- Eyota	Severe: slope.	Severe: slope, seepage.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
485---------- Lawler	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Good.
486---------- Marshan	Severe: wetness, floods, poor filter.	Severe: wetness, floods, seepage.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness, too sandy, seepage.
487---------- Hoopeston	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
488F, 488G---------- Brodale	Severe: slope, depth to rock.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope, small stones.
489A---------- Atkinson	Severe: depth to rock.	Moderate: depth to rock, seepage.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim.
489B---------- Atkinson	Severe: depth to rock.	Moderate: slope, depth to rock, seepage.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim.
491B---------- Waucoma	Moderate: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim.
492B---------- Nasset	Moderate: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim.
492C---------- Nasset	Moderate: depth to rock, slope.	Severe: slope.	Severe: depth to rock.	Moderate: slope, depth to rock.	Fair: slope, area reclaim.
493B---------- Oronoco	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
493C---------- Oronoco	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
493D---------- Oronoco	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
495---------- Zumbro	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.

TABLE 9.--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
516A, 516B---------- Dowagiac	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage.
516C---------- Dowagiac	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage.
528B---------- Palms	Severe: wetness, subsides.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness, hard to pack.
593D, 593E---------- Elbaville	Severe: slope, percs slowly.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: slope, small stones.
898F*: Brodale---------- Bellechester------- 973D*: Brodale---------- Sogn----------	Severe: slope, depth to rock. Severe: slope, poor filter. Severe: slope, depth to rock. Severe: depth to rock.	Severe: slope. Severe: seepage, slope. Severe: slope. Severe: depth to rock, slope.	Severe: depth to rock, slope. Severe: seepage, slope, depth to rock. Severe: depth to rock, slope. Severe: depth to rock.	Severe: slope. Severe: seepage, slope. Severe: slope. Severe: depth to rock.	Poor: slope, small stones. Poor: too sandy, seepage, slope. Poor: slope, small stones. Poor: area reclaim.
1013*. Pits					
1029*. Pits					
1039*. Urban land					
1078*. Udorthents					
1811B*: Lamont---------- Racine----------	Severe: poor filter. Slight----------	Severe: seepage. Moderate: slope, seepage.	Severe: seepage. Slight----------	Severe: seepage. Slight----------	Good. Good.
1812B---------- Terril	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
1819G*: Dorerton---------- Rock outcrop.	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.

See footnote at end of table.

TABLE 9.--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
1832C*:					
Ostrander	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Dowagiac	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage.
1846 Kato	Severe: wetness, floods, poor filter.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness, too sandy, seepage.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2A, 2B---- Ostrander	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11C---- Sogn	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
16---- Arenzville	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
19---- Chaseburg	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
23---- Skyberg	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
24---- Kasson	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
25---- Becker	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
27A, 27B---- Dickinson	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
27C---- Dickinson	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: slope.
30B---- Kenyon	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
42E---- Salida	Fair: slope.	Good	Good	Poor: small stones, slope, area reclaim.
73F---- Bellechester	Poor: slope.	Poor: thin layer.	Unsuited: excess fines.	Poor: slope.
99B---- Racine	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
99C---- Racine	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
99D2---- Racine	Fair: low strength, shrink-swell, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
131B---- Massbach	Poor: low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
131C---- Massbach	Poor: low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
131D---- Massbach	Poor: low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
143B, 143C---------- Eleva	Poor: area reclaim, thin layer.	Poor: thin layer.	Unsuited: excess fines.	Fair: area reclaim, small stones.
173F---------- Frontenac	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: slope.
176---------- Garwin	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
203---------- Joy	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
209A, 209B---------- Kegonsa	Good----------	Good----------	Good----------	Good.
216B---------- Lamont	Good----------	Fair: excess fines.	Unsuited: excess fines.	Good.
244C---------- Lilah	Good----------	Good----------	Good----------	Poor: area reclaim.
251F, 251G---------- Marlean	Poor: area reclaim.	Poor: excess fines.	Poor: excess fines.	Poor: slope, area reclaim, large stones.
252---------- Marshan	Poor: wetness.	Good----------	Unsuited: excess fines.	Good.
283B---------- Plainfield	Good----------	Good----------	Unsuited: excess fines.	Fair: too sandy.
283C---------- Plainfield	Good----------	Good----------	Unsuited: excess fines.	Poor: too sandy.
283E---------- Plainfield	Fair: slope.	Good----------	Unsuited: excess fines.	Poor: too sandy, slope.
285A, 285B, 285C------ Port Byron	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
289---------- Radford	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
295---------- Readlyn	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
298---------- Richwood	Fair: low strength, thin layer, shrink-swell.	Fair: excess fines.	Unsuited: excess fines.	Good.
299A, 299B---------- Rockton	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, thin layer.
299C---------- Rockton	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, area reclaim, thin layer.
301B---------- Lindstrom	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
301C---------- Lindstrom	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
309C---------- Schapville	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
309D---------- Schapville	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
312B---------- Shullsburg	Poor: wetness, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
312C---------- Shullsburg	Poor: wetness, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, slope.
313---------- Spillville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
322C---------- Timula	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
322D, 322E---------- Timula	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
333---------- Vasa	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
340B---------- Whalan	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
340C---------- Whalan	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer, area reclaim.
369B---------- Waubeek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
369C---------- Waubeek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
378---------- Maxfield	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
401B---------- Mt. Carroll	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
401C, 401C2---------- Mt. Carroll	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
401D, 401D2, 401E----- Mt. Carroll	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
463---------- Minneiska	Fair: wetness, low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
465--Kalmarville	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.
467--Sawmill	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
468--Otter	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
471--Root	Poor: wetness.	Poor: large stones.	Poor: large stones.	Poor: wetness.
472B, 472C--Channahon	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
473D--Dorerton	Fair: large stones, slope.	Poor: excess fines, large stones.	Poor: excess fines, large stones.	Poor: slope, area reclaim.
473F--Dorerton	Poor: slope.	Poor: excess fines, large stones.	Poor: excess fines, large stones.	Poor: slope, area reclaim.
474B--Haverhill	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey.
475B--Backbone	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
476B--Frankville	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
476C--Frankville	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, slope.
477A, 477B--Littleton	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
478B--Coggon	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
479--Floyd	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
483A, 483B--Waukee	Good	Good	Unsuited: excess fines.	Good.
484C--Eyota	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
484E--Eyota	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
485--Lawler	Good	Good	Good	Good.
486--Marshan	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
487---------- Hoopeston	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Good.
488F, 488G---------- Brodale	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: large stones, slope.
489A, 489B---------- Atkinson	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
491B---------- Waucoma	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
492B---------- Nasset	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
492C---------- Nasset	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
493B---------- Oronoco	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
493C---------- Oronoco	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
493D---------- Oronoco	Fair: low strength, slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
495---------- Zumbro	Good----------	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
516A, 516B---------- Dowagiac	Good----------	Good----------	Good----------	Good.
516C---------- Dowagiac	Good----------	Good----------	Good----------	Fair: slope.
528B---------- Palms	Poor: wetness, low strength.	Unsuited: excess humus, excess fines.	Unsuited: excess humus, excess fines.	Poor: wetness, excess humus.
593D, 593E---------- Elbaville	Fair: large stones.	Poor: excess fines, large stones.	Poor: excess fines, large stones.	Poor: slope.
898F*: Brodale----------	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: large stones, slope.
Bellechester----------	Poor: slope.	Poor: thin layer.	Unsuited: excess fines.	Poor: slope.
973D*: Brodale----------	---	Poor: excess fines.	Poor: excess fines.	Poor: large stones, slope.
Sogn----------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
1013*. Pits				
1029*. Pits				

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1039*. Urban land				
1078*. Udorthents				
1811B*: Lamont	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Racine	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
1812B Terril	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
1819G*: Dorerton	Poor: slope.	Poor: excess fines, large stones.	Poor: excess fines, large stones.	Poor: slope, area reclaim.
Rock outcrop.				
1832C*: Ostrander	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Dowagiac	Good	Good	Good	Fair: slope.
1846 Kato	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
2A---- Ostrander	Seepage	Favorable	Not needed	Favorable	Favorable	Erodes easily.
2B---- Ostrander	Slope, seepage.	Favorable	Not needed	Slope	Favorable	Erodes easily.
11C---- Sogn	Slope, depth to rock.	Thin layer	Not needed	Rooting depth, slope.	Depth to rock	Slope, rooting depth.
16---- Arenzville	Seepage	Favorable	Not needed	Floods, erodes easily.	Not needed	Erodes easily.
19---- Chaseburg	Seepage	Favorable	Not needed	Erodes easily, floods.	Not needed	Erodes easily.
23---- Skyberg	Favorable	Wetness	Frost action	Wetness	Wetness, erodes easily.	Wetness, percs slowly.
24---- Kasson	Favorable	Wetness	Frost action	Wetness	Wetness	Favorable.
25---- Becker	Seepage	Seepage	Not needed	Favorable	Favorable	Favorable.
27A---- Dickinson	Seepage	Seepage	Not needed	Soil blowing	Soil blowing, too sandy.	Favorable.
27B---- Dickinson	Slope, seepage.	Seepage	Not needed	Soil blowing, slope.	Soil blowing, too sandy.	Favorable.
27C---- Dickinson	Slope, seepage.	Seepage	Not needed	Soil blowing, slope.	Soil blowing, too sandy, slope.	Slope.
30B---- Kenyon	Slope	Favorable	Not needed	Slope	Favorable	Favorable.
42E---- Salida	Seepage, slope.	Seepage	Not needed	Slope, droughty, fast intake.	Slope, too sandy.	Slope, droughty.
73F---- Bellechester	Depth to rock, seepage, slope.	Seepage, piping, thin layer.	Not needed	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
99B---- Racine	Slope, seepage.	Favorable	Not needed	Slope	Favorable	Favorable.
99C---- Racine	Slope, seepage.	Favorable	Not needed	Slope	Favorable	Slope.
99D2---- Racine	Slope, seepage.	Favorable	Not needed	Slope	Slope	Slope.
131B---- Massbach	Depth to rock, slope.	Thin layer	Not needed	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
131C, 131D---- Massbach	Depth to rock, slope.	Thin layer	Not needed	Percs slowly, slope.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
143B, 143C---- Eleva	Depth to rock, seepage.	Thin layer	Not needed	Slope, soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
173F---- Frontenac	Slope, seepage.	Large stones	Not needed	Slope	Slope	Slope.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
176--- Garwin	Seepage---	Wetness, hard to pack.	Frost action---	Wetness---	Wetness---	Wetness.
203--- Joy	Seepage---	Wetness---	Frost action---	Wetness---	Wetness, erodes easily.	Erodes easily.
209A--- Kegonsa	Seepage---	Seepage---	Not needed---	Favorable---	Too sandy, erodes easily.	Erodes easily.
209B--- Kegonsa	Slope, seepage.	Seepage---	Not needed---	Slope---	Too sandy, erodes easily.	Erodes easily.
216B--- Lamont	Slope, seepage.	Piping, seepage.	Not needed---	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.
244C--- Lilah	Seepage, slope.	Seepage---	Not needed---	Droughty, soil blowing, slope.	Too sandy, soil blowing, slope.	Slope, droughty.
251F, 251G--- Marlean	Slope, seepage, depth to rock.	Seepage, large stones.	Not needed---	Slope, depth to rock.	Large stones, slope, depth to rock.	Slope, large stones, depth to rock.
252--- Marshan	Seepage---	Wetness, seepage.	Frost action---	Wetness---	Wetness---	Wetness.
283B--- Plainfield	Seepage, slope.	Seepage---	Not needed---	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
283C, 283E--- Plainfield	Seepage, slope.	Seepage---	Not needed---	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Droughty, slope.
285A--- Port Byron	Seepage---	Favorable---	Not needed---	Favorable---	Erodes easily	Erodes easily.
285B, 285C--- Port Byron	Slope, seepage.	Favorable---	Not needed---	Slope---	Erodes easily	Erodes easily.
289--- Radford	Seepage---	Wetness---	Frost action, floods.	Wetness, floods.	Wetness---	Wetness.
295--- Readlyn	Favorable---	Wetness---	Frost action---	Wetness---	Wetness---	Favorable.
298--- Richwood	Seepage---	Thin layer---	Not needed---	Favorable---	Erodes easily	Erodes easily.
299A--- Rockton	Depth to rock, seepage.	Thin layer---	Not needed---	Depth to rock	Depth to rock	Depth to rock.
299B--- Rockton	Slope, seepage, depth to rock.	Thin layer---	Not needed---	Slope, depth to rock.	Depth to rock	Depth to rock.
299C--- Rockton	Slope, seepage, depth to rock.	Thin layer---	Not needed---	Slope, depth to rock.	Slope, depth to rock.	Depth to rock, slope.
301B--- Lindstrom	Slope, seepage.	Piping---	Not needed---	Slope---	Erodes easily	Erodes easily.
301C--- Lindstrom	Slope, seepage.	Piping---	Not needed---	Slope---	Slope, erodes easily.	Slope, erodes easily.
309C, 309D--- Schapville	Slope, depth to rock.	Thin layer, hard to pack.	Not needed---	Percs slowly, slope, depth to rock.	Slope, percs slowly, depth to rock.	Slope, depth to rock, percs slowly.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
312B---------- Shullsburg	Depth to rock, slope.	Thin layer, hard to pack.	Percs slowly, depth to rock, frost action.	Wetness, percs slowly, depth to rock.	Depth to rock, wetness.	Wetness, depth to rock.
312C---------- Shullsburg	Depth to rock, slope.	Thin layer, hard to pack.	Percs slowly, depth to rock, frost action.	Wetness, percs slowly, depth to rock.	Slope, depth to rock, wetness.	Wetness, slope, depth to rock.
313---------- Spillville	Seepage--------	Favorable------	Not needed-----	Floods---------	Favorable------	Favorable.
322C, 322D, 322E-- Timula	Seepage, slope.	Piping---------	Not needed-----	Erodes easily, slope.	Slope----------	Slope, erodes easily.
333---------- Vasa	Seepage--------	Wetness--------	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
340B---------- Whalan	Slope, depth to rock.	Thin layer-----	Not needed-----	Slope, depth to rock.	Depth to rock	Depth to rock.
340C---------- Whalan	Slope, depth to rock.	Thin layer-----	Not needed-----	Slope, depth to rock.	Depth to rock, slope.	Slope, depth to rock.
369B---------- Waubeek	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Erodes easily	Erodes easily.
369C---------- Waubeek	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Erodes easily, slope.	Slope, erodes easily.
378---------- Maxfield	Seepage--------	Wetness, hard to pack.	Frost action---	Wetness--------	Wetness--------	Wetness.
401B---------- Mt. Carroll	Seepage, slope.	Favorable------	Not needed-----	Slope----------	Erodes easily	Erodes easily.
401C, 401C2, 401D, 401D2, 401E------ Mt. Carroll	Seepage, slope.	Favorable------	Not needed-----	Slope----------	Slope, erodes easily.	Slope, erodes easily.
463---------- Minneiska	Seepage--------	Piping---------	Not needed-----	Floods---------	Favorable------	Favorable.
465---------- Kalmarville	Seepage--------	Piping, seepage.	Floods, frost action.	Floods, wetness.	Wetness--------	Wetness.
467---------- Sawmill	Favorable------	Wetness--------	Floods, frost action.	Wetness, floods.	Wetness--------	Wetness.
468---------- Otter	Seepage--------	Wetness--------	Floods, frost action.	Wetness, floods.	Wetness--------	Wetness.
471---------- Root	Seepage--------	Seepage, wetness.	Floods, frost action.	Floods, wetness.	Wetness--------	Large stones, wetness.
472B---------- Channahon	Depth to rock, slope.	Thin layer-----	Not needed-----	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
472C---------- Channahon	Depth to rock, slope.	Thin layer-----	Not needed-----	Depth to rock, slope, erodes easily.	Depth to rock, slope, erodes easily.	Slope, erodes easily, depth to rock.
473D, 473F-------- Dorerton	Seepage, slope.	Seepage, large stones.	Not needed-----	Large stones, slope.	Large stones, slope.	Large stones, slope.
474B---------- Haverhill	Depth to rock, slope.	Hard to pack, thin layer, wetness.	Percs slowly, frost action, depth to rock.	Wetness, slow intake, percs slowly.	Depth to rock, wetness, percs slowly.	Wetness, erodes easily, depth to rock.
475B---------- Backbone	Slope, depth to rock, seepage.	Thin layer-----	Not needed-----	Depth to rock, soil blowing, slope.	Depth to rock, soil blowing.	Depth to rock.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
476B--Frankville	Depth to rock, slope.	Thin layer	Not needed	Slope, depth to rock.	Depth to rock, erodes easily.	Depth to rock, erodes easily.
476C--Frankville	Depth to rock, slope.	Thin layer	Not needed	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Slope, depth to rock, erodes easily.
477A, 477B--Littleton	Seepage	Favorable	Frost action	Wetness	Erodes easily, wetness.	Erodes easily, wetness.
478B--Coggon	Slope	Favorable	Not needed	Slope	Favorable	Favorable.
479--Floyd	Seepage	Wetness	Frost action	Wetness	Wetness	Favorable.
483A--Waukee	Seepage	Seepage	Not needed	Favorable	Too sandy	Favorable.
483B--Waukee	Slope, seepage.	Seepage	Not needed	Slope	Too sandy	Favorable.
484C--Eyota	Slope, seepage.	Piping	Not needed	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
484E--Eyota	Slope, seepage.	Piping	Not needed	Fast intake, soil blowing, slope.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
485--Lawler	Seepage	Seepage	Frost action	Wetness	Wetness, too sandy.	Favorable.
486--Marshan	Seepage	Wetness, seepage.	Floods, frost action.	Wetness, floods.	Wetness	Wetness.
487--Hoopeston	Seepage	Seepage	Frost action	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Wetness.
488F, 488G--Brodale	Seepage, slope, depth to rock.	Large stones, piping.	Not needed	Slope, droughty, rooting depth.	Slope, large stones.	Slope, large stones, droughty.
489A--Atkinson	Depth to rock	Thin layer	Not needed	Favorable	Favorable	Favorable.
489B--Atkinson	Slope, depth to rock.	Thin layer	Not needed	Slope	Favorable	Favorable.
491B--Waucoma	Depth to rock, seepage, slope.	Thin layer	Not needed	Slope	Favorable	Favorable.
492B--Nasset	Depth to rock, seepage, slope.	Thin layer	Not needed	Slope	Erodes easily	Erodes easily.
492C--Nasset	Depth to rock, seepage, slope.	Thin layer	Not needed	Slope	Slope, erodes easily.	Slope, erodes easily.
493B--Oronoco	Seepage, slope.	Piping	Not needed	Slope	Favorable	Favorable.
493C--Oronoco	Seepage, slope.	Piping	Not needed	Slope	Slope	Slope.
493D--Oronoco	Seepage, slope.	Piping	Not needed	Soil blowing	Slope, soil blowing.	Slope.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
495---------- Zumbro	Seepage--------	Seepage--------	Not needed-----	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
516A---------- Dowagiac	Seepage--------	Seepage--------	Not needed-----	---	---	Favorable.
516B---------- Dowagiac	Seepage, slope.	Seepage--------	Not needed-----			Favorable.
516C---------- Dowagiac	Seepage, slope.	Seepage--------	Not needed-----	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
528B---------- Palms	Seepage--------	Excess humus, wetness.	Floods, frost action, excess humus.	Wetness, soil blowing.	Wetness--------	Wetness.
593D, 593E-------- Elbaville	Seepage, slope.	Large stones, seepage.	Not needed-----	Slope----------	Slope----------	Slope.
898F*:						
Brodale----------	Seepage, slope, depth to rock.	Large stones, piping.	Not needed-----	Slope, droughty, rooting depth.	Slope, large stones.	Slope, large stones, droughty.
Bellechester-----	Depth to rock, seepage, slope.	Seepage, piping, thin layer.	Not needed-----	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
973D*:						
Brodale----------	Seepage, slope, depth to rock.	Large stones, piping.	Not needed-----	Slope, droughty, rooting depth.	Slope, large stones.	Slope, large stones, droughty.
Sogn--- ---------	Slope, depth to rock.	Thin layer-----	Not needed-----	Rooting depth, slope.	Depth to rock, slope.	Slope, rooting depth.
1013*. Pits						
1029*. Pits						
1039*. Urban land						
1078*. Udorthents						
1811B*:						
Lamont----------	Slope, seepage.	Piping, seepage.	Not needed-----	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.
Racine----------	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Favorable------	Favorable.
1812B---------- Terril	Seepage, slope.	Favorable------	Not needed-----	Slope----------	Too sandy------	Favorable.
1819G*:						
Dorerton---------	Seepage, slope.	Seepage, large stones.	Not needed-----	Large stones, slope.	Large stones, slope.	Large stones, slope.
Rock outcrop.						
1832C*:						
Ostrander--------	Slope, seepage.	Favorable------	Not needed-----	Slope----------	Slope----------	Slope, erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1832C*: Dowagiac	Seepage, slope.	Seepage	Not needed	Slope	Slope, too sandy.	Slope.
1846 Kato	Seepage	Seepage, wetness.	Floods, frost action.	Wetness, floods.	Wetness	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--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
2A Ostrander	Slight	Slight	Slight	Slight.
2B Ostrander	Slight	Slight	Moderate: slope.	Slight.
11C Sogn	Severe: depth to rock.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
16 Arenzville	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
19 Chaseburg	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
23 Skyberg	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
24 Kasson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight.
25 Becker	Severe: floods.	Slight	Slight	Slight.
27A Dickinson	Slight	Slight	Slight	Slight.
27B Dickinson	Slight	Slight	Moderate: slope.	Slight.
27C Dickinson	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
30B Kenyon	Slight	Slight	Moderate: slope.	Slight.
42E Salida	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
73F Bellechester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
99B Racine	Slight	Slight	Moderate: slope.	Slight.
99C Racine	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
99D2 Racine	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
131B Massbach	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
131C Massbach	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
131D Massbach	Severe: slope.	Severe: slope.	Severe: slope.	Slight.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
143B, 143C---------- Eleva	Slight----------	Slight----------	Moderate: depth to rock, slope.	Slight.
173F---------- Frontenac	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
176---------- Garwin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
203---------- Joy	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
209A---------- Kegonsa	Slight----------	Slight----------	Slight----------	Slight.
209B---------- Kegonsa	Slight----------	Slight----------	Moderate: slope.	Slight.
216B---------- Lamont	Slight----------	Slight----------	Moderate: slope.	Slight.
244C---------- Lilah	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
251F, 251G---------- Marlean	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
252---------- Marshan	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
283B---------- Plainfield	Slight----------	Slight----------	Moderate: slope.	Slight.
283C---------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
283E---------- Plainfield	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
285A---------- Port Byron	Slight----------	Slight----------	Slight----------	Slight.
285B---------- Port Byron	Slight----------	Slight----------	Moderate: slope.	Slight.
285C---------- Port Byron	Slight----------	Slight----------	Severe: slope.	Slight.
289---------- Radford	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
295---------- Readlyn	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.
298---------- Richwood	Severe: floods.	Slight----------	Slight----------	Slight.
299A---------- Rockton	Slight----------	Slight----------	Slight----------	Slight.
299B---------- Rockton	Slight----------	Slight----------	Moderate: depth to rock, slope.	Slight.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
299C---------- Rockton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
301B---------- Lindstrom	Slight----------	Slight----------	Moderate: slope.	Slight.
301C---------- Lindstrom	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
309C---------- Schapville	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight.
309D---------- Schapville	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.
312B---------- Shullsburg	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
312C---------- Shullsburg	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.
313---------- Spillville	Severe: floods.	Slight----------	Moderate: floods.	Slight.
322C---------- Timula	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
322D, 322E---------- Timula	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
333---------- Vasa	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.
340B---------- Whalan	Slight----------	Slight----------	Moderate: depth to rock, slope.	Slight.
340C---------- Whalan	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
369B---------- Waubeek	Slight----------	Slight----------	Moderate: slope.	Slight.
369C---------- Waubeek	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
378---------- Maxfield	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
401B---------- Mt. Carroll	Slight----------	Slight----------	Moderate: slope.	Slight.
401C, 401C2---------- Mt. Carroll	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
401D, 401D2, 401E----- Mt. Carroll	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
463---------- Minneiska	Severe: floods.	Slight----------	Moderate: floods.	Slight.
465---------- Kalmarville	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
467--Sawmill	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
468--Otter	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
471--Root	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
472B--Channahon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight.
472C--Channahon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Slight.
473D--Dorerton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
473F--Dorerton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
474B--Haverhill	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.
475B--Backbone	Slight	Slight	Moderate: slope, depth to rock.	Slight.
476B--Frankville	Slight	Slight	Moderate: slope, depth to rock.	Slight.
476C--Frankville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
477A--Littleton	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
477B--Littleton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
478B--Coggon	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
479--Floyd	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
483A--Waukee	Slight	Slight	Slight	Slight.
483B--Waukee	Slight	Slight	Moderate: slope.	Slight.
484C--Eyota	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
484E--Eyota	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
485--Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
486--Marshan	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
487--Hoopeston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
488F, 488G--Brodale	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: large stones, slope.
489A--Atkinson	Slight	Slight	Slight	Slight.
489B--Atkinson	Slight	Slight	Moderate: slope.	Slight.
491B--Waucoma	Slight	Slight	Moderate: slope.	Slight.
492B--Nasset	Slight	Slight	Moderate: slope.	Slight.
492C--Nasset	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
493B--Oronoco	Slight	Slight	Moderate: slope.	Slight.
493C--Oronoco	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
493D--Oronoco	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
495--Zumbro	Severe: floods.	Slight	Slight	Slight.
516A--Dowagiac	Slight	Slight	Slight	Slight.
516B--Dowagiac	Slight	Slight	Moderate: slope.	Slight.
516C--Dowagiac	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
528B--Palms	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
593D, 593E--Elbaville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
898F*:				
Brodale	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: large stones, slope.
Bellechester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
973D*:				
Brodale	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
973D*: Sogn	Severe: depth to rock.	Moderate: slope.	Severe: depth to rock, slope.	Slight.
1013*. Pits				
1029*. Pits				
1039*. Urban land				
1078*. Udorthents				
1811B*: Lamont	Slight	Slight	Moderate: slope.	Slight.
Racine	Slight	Slight	Moderate: slope.	Slight.
1812B Terril	Slight	Slight	Moderate: slope.	Slight.
1819G*: Dorerton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
1832C*: Ostrander	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Dowagiac	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
1846 Kato	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
2A, 2B---- Ostrander	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11C---- Sogn	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
16---- Arenzville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
19---- Chaseburg	Poor	Good	Good	Good	Fair	Poor	Poor	Fair	Good	Poor.
23---- Skyberg	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
24---- Kasson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Fair	Very poor.
25---- Becker	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Good.
27A, 27B---- Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
27C---- Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
30B---- Kenyon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
42E---- Salida	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
73F---- Bellechester	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
99B---- Racine	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
99C---- Racine	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
99D2---- Racine	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
131B---- Massbach	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
131C---- Massbach	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
131D---- Massbach	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
143B, 143C---- Eleva	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
173F---- Frontenac	Very poor.	Very poor.	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
176---- Garwin	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--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
203---- Joy	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
209A, 209B---- Kegonsa	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
216B---- Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
244C---- Lilah	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
251F, 251G---- Marlean	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
252---- Marshan	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
283B---- Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
283C, 283E---- Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
285A, 285B---- Port Byron	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
285C---- Port Byron	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
289---- Radford	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
295---- Readlyn	Good	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
298---- Richwood	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
299A, 299B, 299C--- Rockton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
301B---- Lindstrom	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
301C---- Lindstrom	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
309C---- Schapville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
309D---- Schapville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
312B---- Shullsburg	Good	Good	Fair	Fair	Good	Good	Fair	Good	Fair	Fair.
312C---- Shullsburg	Fair	Good	Fair	Fair	Good	Poor	Very poor.	Fair	Fair	Very poor.
313---- Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
322C---- Timula	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
322D, 322E---- Timula	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--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
333---------- Vasa	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
340B, 340C---------- Whalan	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
369B---------- Waubeek	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
369C---------- Waubeek	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
378---------- Maxfield	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
401B---------- Mt. Carroll	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
401C, 401C2--------- Mt. Carroll	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
401D, 401D2, 401E-- Mt. Carroll	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
463---------- Minneiska	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
465---------- Kalmarville	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
467---------- Sawmill	Good	Good	Good	Fair	Fair	Good	Fair	Good	Fair	Poor.
468---------- Otter	Good	Fair	Good	Good	Fair	Good	Good	Good	Good	Good.
471---------- Root	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Fair.
472B, 472C--------- Channahon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
473D---------- Dorerton	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
473F---------- Dorerton	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
474B---------- Haverhill	Very poor.	Fair	Fair	Poor	Poor	Good	Poor	Poor	Poor	Fair.
475B---------- Backbone	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
476B---------- Frankville	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
476C---------- Frankville	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
477A---------- Littleton	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
477B---------- Littleton	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
478B---------- Coggon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--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
479---- Floyd	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
483A, 483B---- Waukee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
484C---- Eyota	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
484E---- Eyota	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
485---- Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
486---- Marshan	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
487---- Hoopeston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
488F, 488G---- Brodale	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.
489A, 489B---- Atkinson	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
491B---- Waucoma	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
492B, 492C---- Nasset	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
493B---- Oronoco	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Poor.
493C---- Oronoco	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Poor.
493D---- Oronoco	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Poor.
495---- Zumbro	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
516A, 516B---- Dowagiac	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
516C---- Dowagiac	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
528B---- Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
593D---- Elbaville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
593E---- Elbaville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
898F*:										
Brodale----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.
Bellechester----	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--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
973D*:										
Brodale	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.
Sogn	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
1013*. Pits										
1029*. Pits										
1039*. Urban land										
1078*. Udorthents										
1811B*:										
Lamont	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Racine	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1812B Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
1819G*:										
Dorerton	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
1832C*:										
Ostrander	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Dowagiac	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
1846 Kato	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[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		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
2A---------- Ostrander	0-13	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	98-100	90-95	70-90	25-40	5-15
	13-38	Loam, silt loam	CL, CL-ML	A-4	0-1	95-100	98-100	90-95	70-90	25-40	5-15
	38-50	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	0-2	95-100	75-98	65-90	45-65	25-35	10-15
	50-60	Loam----------	CL	A-6	0-1	95-100	90-98	80-95	50-75	25-40	10-20
2B---------- Ostrander	0-14	Loam----------	CL-ML, CL	A-4, A-6	0	100	98-100	90-95	70-90	25-40	5-15
	14-18	Loam, silt loam	CL, CL-ML	A-4	0-1	95-100	98-100	90-95	70-90	25-40	5-15
	18-40	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	0-2	95-100	75-98	65-90	45-65	25-35	10-15
	40-70	Loam----------	CL	A-6	0-1	95-100	90-98	80-95	50-75	25-40	10-20
11C---------- Sogn	0-8	Loam----------	CL	A-6	0-10	85-100	85-100	85-100	70-95	25-40	11-23
	8	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
16---------- Arenzville	0-31	Silt loam-------	ML, CL-ML, CL	A-4	0	100	100	95-100	80-90	25-35	5-10
	31-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	70-95	20-45	5-20
19---------- Chaseburg	0-60	Silt loam-------	ML, CL-ML	A-4	0	100	100	90-100	85-100	<25	NP-5
23---------- Skyberg	0-11	Silt loam-------	CL-ML, CL	A-6, A-4	0	100	95-100	90-100	85-100	20-40	4-20
	11-24	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-45	15-25
	24-46	Loam, fine sandy loam.	CL, CL-ML	A-6, A-4	0-1	90-100	85-100	80-95	50-70	25-40	4-19
	46-70	Loam----------	CL, CL-ML	A-6, A-4	0-1	90-100	85-100	80-95	50-70	25-40	4-19
24---------- Kasson	0-9	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	75-95	25-40	4-15
	9-22	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	75-95	35-45	15-25
	22-60	Loam, clay loam, sandy clay loam.	CL, ML	A-6, A-7	0	95-100	85-100	85-95	50-80	30-45	10-18
25---------- Becker	0-30	Loam, sandy loam	ML, CL-ML, SM	A-4	0	100	85-100	75-95	40-70	15-30	3-10
	30-36	Loamy coarse sand, loamy fine sand, gravelly loamy coarse sand.	SM, SP-SM	A-2, A-1	0	95-100	65-100	35-75	15-35	<20	NP
	36-60	Coarse sand, loamy coarse sand, loamy fine sand.	SM, SP-SM	A-1, A-2, A-3	0	95-100	65-100	35-70	5-15	<20	NP
27A, 27B, 27C------ Dickinson	0-15	Sandy loam------	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	15-28	Fine sandy loam, sandy loam.	SM, SC, SM-SC	A-4	0	100	100	85-95	35-50	15-30	NP-10
	28-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
30B---------- Kenyon	0-13	Loam, clay loam	CL	A-6	0	100	95-100	85-95	65-75	30-40	10-20
	13-50	Loam, clay loam	CL	A-6	0-5	90-95	85-95	80-90	50-65	30-40	10-20
	50-65	Loam----------	CL	A-6	0-5	90-95	85-95	80-90	50-65	25-35	10-20

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
42E---------- Salida	0-6	Gravelly sandy loam.	SM, SP-SM	A-2, A-1	0-5	85-95	60-75	30-60	12-20	---	NP
	6-12	Gravelly loamy sand, gravelly coarse sand, gravelly loamy coarse sand.	SP, SW, GP, GP-GM	A-1	0-5	50-90	40-60	10-30	0-5	---	NP
	12-60	Gravelly coarse sand, gravel.	SP, SW, GP, GP-GM	A-1	0-5	20-70	10-60	5-30	0-5	---	NP
73F---------- Bellechester	0-20	Loamy sand------	SP-SM, SM	A-3, A-2	0-10	90-100	85-100	70-90	5-15	<20	NP
	20-43	Sand, fine sand, loamy sand.	SP, SP-SM	A-3	0-45	85-100	70-100	50-90	3-10	<20	NP
	43	Weathered bedrock.	---	---	---	---	---	---	---	---	---
99B, 99C, 99D2----- Racine	0-12	Silt loam, loam	ML	A-4, A-6	0	95-100	95-100	90-100	55-85	30-40	5-14
	12-18	Silt loam, clay loam, silty clay loam.	CL	A-6	0	95-100	95-100	90-100	55-85	30-40	10-20
	18-46	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-2, A-6	0-3	85-100	75-95	65-90	30-85	20-40	NP-15
	46-65	Loam----------	ML, CL, SM, SC	A-4, A-6	0-3	85-100	80-95	70-90	35-75	20-40	3-20
131B, 131C, 131D--- Massbach	0-7	Silt loam-------	ML	A-4	0	100	100	95-100	90-100	30-40	5-10
	7-37	Silt loam-------	CL, ML	A-6, A-7	0	100	100	95-100	90-100	30-45	8-20
	37-45	Silty clay loam, silty clay, clay.	CL, CH	A-7, A-6	0-5	95-100	90-100	85-100	75-95	30-55	15-35
	45-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
143B, 143C--------- Eleva	0-9	Sandy loam------	SM, SM-SC	A-2, A-4	0	95-100	80-100	50-90	25-50	<20	NP-7
	9-21	Loam, sandy loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	0	45-100	80-100	50-95	25-65	<25	NP-7
	21-32	Sand, fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	95-100	80-100	40-85	5-35	<20	NP-4
	32	Weathered bedrock.	---	---	---	---	---	---	---	---	---
173F---------- Frontenac	0-14	Loam----------	ML, CL	A-4, A-6	0	95-100	85-100	70-100	60-90	30-40	5-15
	14-27	Loam, silt loam	ML	A-4, A-6	0-10	95-100	75-100	70-90	60-85	30-40	5-15
	27-60	Cobbly loam, flaggy loam, channery loam.	SM, GM	A-2	25-50	45-85	35-75	30-55	25-35	30-40	5-10
176---------- Garwin	0-13	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	13-33	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	33-65	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	15-20
203---------- Joy	0-20	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	20-40	Silt loam-------	CL	A-6	0	100	100	100	95-100	25-40	10-20
	40-65	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
209A, 209B--------- Kegonsa	0-12	Silt loam-------	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	20-30	3-10
	12-25	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	80-95	25-40	10-20
	25-29	Sandy clay loam, clay loam, loam.	CL, SC	A-6, A-2	0	90-100	80-100	65-100	30-80	25-40	10-21
	29-60	Stratified sand to gravel.	SP, GP	A-1	0-5	40-85	35-85	15-35	0-5	---	NP

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
216B----------	0-13	Sandy loam------	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
Lamont	13-20	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
	20-75	Fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
244C----------	0-13	Sandy loam------	SM-SC, SC	A-2, A-4	0-5	90-95	80-90	60-70	25-40	15-25	5-10
Lilah	13-56	Loamy coarse sand, gravelly loamy coarse sand, sand.	SW, SW-SM, SP, SP-SM	A-1-B	0-10	70-80	50-70	30-50	3-12	---	NP
	56-70	Coarse sand, gravelly loamy sand.	GP, SP, GP-GM, SP-SM	A-1-B	0-10	50-60	40-50	30-50	3-12	---	NP
251F, 251G---------	0-10	Silty clay loam	CL	A-6, A-7	0-10	85-95	80-90	70-85	50-85	35-45	15-20
Marlean	10-60	Flaggy loam, flaggy clay loam, flaggy silty clay loam.	SM, SC, GM, GC	A-4, A-2, A-1	20-50	30-70	30-70	25-50	12-40	<20	NP-10
252----------	0-14	Silt loam-------	ML, CL	A-6, A-4	0	95-100	95-100	95-100	60-90	30-40	5-15
Marshan	14-23	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
	23-30	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
	30-60	Coarse sand, gravelly sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
283B----------	0-10	Loamy sand------	SM	A-2, A-4	0	75-100	75-100	40-90	12-40	---	NP
Plainfield	10-60	Sand------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP
283C----------	0-6	Sand------------	SP-SM, SM, SP	A-3, A-2	0	75-100	75-100	40-80	3-35	---	NP
Plainfield	6-60	Sand------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP
283E----------	0-8	Sand------------	SP-SM, SM, SP	A-3, A-2	0	75-100	75-100	40-80	3-35	---	NP
Plainfield	8-60	Sand------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP
285A, 285B, 285C---	0-15	Silt loam-------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	7-18
Port Byron	15-60	Silt loam-------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	7-18
289----------	0-29	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	30-40	5-15
Radford	29-72	Silty clay loam, clay loam, silt loam.	CL, ML	A-6, A-4	0	100	100	95-100	80-95	30-40	5-15
295----------	0-22	Loam------------	CL	A-6	0	100	100	85-95	55-75	30-40	15-25
Readlyn	22-44	Loam, clay loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	30-40	10-20
	44-65	Loam, sandy clay loam.	CL, SC	A-6	2-5	90-95	85-90	75-85	45-65	25-35	10-20

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
298---------- Richwood	0-24	Silt loam-------	ML	A-4	0	100	100	90-100	85-95	25-35	3-10
	24-50	Silt loam, silty clay loam, loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-95	20-35	5-15
	50-59	Stratified silt loam to loamy sand.	CL, ML, SC, SM	A-4	0	100	100	85-95	35-75	<25	2-10
	59-70	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
299A, 299B, 299C--- Rockton	0-15	Loam----------	ML, CL-ML, CL	A-4	0	90-100	90-100	85-95	50-75	25-35	5-10
	15-26	Loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	90-100	90-100	75-90	45-70	30-45	10-20
	26-31	Clay, clay loam, silty clay.	CH, CL	A-7	0-2	90-100	90-100	90-95	70-90	40-60	20-35
	31	Weathered bedrock.	---	---	---	---	---	---	---	---	---
301B, 301C--------- Lindstrom	0-31	Silt loam-------	ML	A-4	0	100	100	95-100	85-95	30-40	5-10
	31-44	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	85-95	30-40	9-14
	44-60	Loam, silt loam, very fine sandy loam.	ML	A-4	0	100	95-100	75-95	50-90	25-35	NP-5
309C, 309D--------- Schapville	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
	7-15	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	15-25
	15-20	Silty clay, clay	CL, CH	A-7, A-6	0-5	90-100	85-100	80-90	65-90	35-55	18-35
	20-60	Weathered bedrock.	CL, CH	A-7, A-6	0-20	90-100	85-100	80-90	65-90	35-55	18-35
312B, 312C--------- Shullsburg	0-17	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-90	20-40	1-15
	17-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	85-90	30-45	11-25
	26-37	Silty clay, clay	CL, CH	A-7	0	100	85-100	80-100	80-95	40-70	20-45
	37-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
313---------- Spillville	0-60	Silt loam, loam	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
	60-70	Coarse sand	SP	A-2, A-3	0	80-100	70-100	50-80	4-20	<20	NP
322C, 322D, 322E--- Timula	0-60	Silt loam-------	ML, CL-ML, CL	A-4	0	100	100	95-100	85-100	26-35	5-10
333---------- Vasa	0-14	Silt loam-------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	14-38	Silt loam-------	CL	A-6, A-7	0	100	100	100	95-100	35-45	12-20
	38-60	Silt loam, loam, very fine sandy loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	85-100	75-100	25-40	5-15
340B, 340C--------- Whalan	0-17	Loam----------	ML	A-4	0	100	95-100	85-95	60-90	30-40	5-10
	17-22	Clay loam, loam	CL	A-6	0	95-100	95-100	80-95	70-90	30-40	10-15
	22-27	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	80-100	70-95	65-90	50-85	40-60	20-35
	27	Weathered bedrock.	---	---	---	---	---	---	---	---	---
369B, 369C--------- Waubeek	0-13	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	100	25-35	5-15
	13-33	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	100	35-50	15-25
	33-70	Loam, sandy clay loam, clay loam.	CL	A-6	0-5	90-95	85-95	75-85	50-65	25-35	10-20
378---------- Maxfield	0-15	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	45-55	20-30
	15-32	Silty clay loam, silt loam.	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
	32-60	Loam----------	CL	A-6	0-5	90-95	85-90	75-85	55-65	23-35	10-20

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
401B, 401C, 401C2, 401D, 401D2, 401E-- Mt. Carroll	0-12	Silt loam-------	CL	A-4, A-6	0	100	100	100	95-100	25-36	7-18
	12-51	Silt loam, silty clay loam.	CL	A-6, A-4	0	100	100	100	95-100	27-40	8-20
	51-60	Silt loam, silt	CL	A-4, A-6	0	100	100	100	90-100	26-37	7-17
463---------- Minneiska	0-39	Loam, sandy loam	ML, CL, CL-ML	A-4	0	100	95-100	70-90	50-75	20-35	3-10
	39-60	Gravelly coarse sand.	SM, SW, SP, SP-SM	A-1	0-5	60-90	60-85	20-40	3-25	---	NP
465---------- Kalmarville	0-43	Silt loam-------	ML, CL, CL-ML	A-4	0	95-100	90-100	85-100	50-90	15-35	NP-10
	43-60	Coarse sand, sand, loamy fine sand.	SP, SM, SW, SP-SM	A-3, A-2, A-1	0-2	90-100	85-100	40-80	2-30	<25	NP
467---------- Sawmill	0-41	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-100	30-50	15-30
	41-65	Stratified silty clay loam to loam.	CL	A-6, A-7	0	100	100	95-100	70-100	25-45	10-30
468---------- Otter	0-22	Silt loam-------	CL	A-6, A-7	0	100	98-100	90-100	80-100	30-45	10-20
	22-65	Stratified silt loam and silty clay loam.	CL, ML	A-4, A-6	0	90-100	80-100	55-95	55-85	20-40	3-20
471---------- Root	0-34	Silt loam-------	CL, CL-ML	A-4, A-6	0-10	70-95	70-95	70-95	60-75	25-35	5-15
	34-50	Channery loam, very channery sandy loam.	GP, GM, SM, SP	A-1, A-2, A-3	25-60	20-80	15-75	10-60	3-35	<20	NP
472B, 472C---------- Channahon	0-12	Loam------------	CL	A-6, A-4	0-20	95-100	95-100	85-100	65-90	21-38	7-18
	12-15	Loam, sandy clay loam, silty clay loam.	CL	A-6, A-7	0-20	95-100	90-100	85-100	50-85	30-46	15-25
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
473D, 473F---------- Dorerton	0-10	Loam------------	ML	A-4	0	100	100	70-95	55-90	20-30	NP-5
	10-18	Loam, clay loam	CL, ML	A-4, A-6	0-5	95-100	85-100	70-95	50-85	30-40	5-15
	18-30	Channery loam, very channery clay loam, very channery loam.	GM, GC, SM, SC	A-2, A-1	20-55	40-75	30-65	20-45	12-35	30-45	5-20
	30-60	Very channery loam, very flaggy loamy sand, flaggy loam.	GW-GM, SP-SM, SM	A-1, A-2	20-55	40-75	30-65	15-40	5-30	<20	NP
474B---------- Haverhill	0-13	Clay------------	CH, OH	A-7	0-2	90-100	85-100	80-98	80-95	50-70	25-35
	13-32	Clay, silty clay, channery clay.	CL, CH	A-7	5-25	75-95	70-90	65-90	60-85	40-70	20-45
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
475B---------- Backbone	0-9	Sandy loam------	SM-SC, SC	A-2, A-4	0	100	100	75-85	15-40	15-25	5-10
	9-23	Sandy loam------	SC, SM-SC	A-2, A-4	0-2	90-95	90-95	65-80	20-40	15-25	5-10
	23-28	Clay loam, clay	CL, CH	A-6, A-7	2-5	90-95	90-95	70-80	50-75	35-55	20-30
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
476B, 476C---------- Frankville	0-12	Silt loam-------	ML, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	12-37	Silt loam, silty clay loam, clay.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
477A, 477B--------- Littleton	0-40	Silt loam--------	CL	A-4, A-6	0	100	100	98-100	90-100	29-40	8-19
	40-71	Silt loam--------	CL	A-4, A-6	0	100	100	98-100	80-100	23-40	7-21
478B---------- Coggon	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	90-95	65-85	20-30	5-15
	12-55	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	10-20
	55-65	Loam----------	CL	A-6	2-5	90-95	85-95	80-90	50-65	30-40	10-20
479---------- Floyd	0-8	Silt loam--------	OL, MH, ML, OH	A-7	0	100	100	80-90	55-75	45-60	15-25
	8-26	Clay loam, loam, silt loam.	CL	A-6, A-4	2-8	90-100	70-80	50-70	50-75	25-40	8-20
	26-65	Loam----------	CL	A-6	2-5	90-95	85-95	70-85	50-65	25-35	11-20
483A, 483B--------- Waukee	0-10	Loam----------	CL	A-6	0	100	90-100	70-90	50-75	30-40	10-20
	10-31	Loam, sandy loam	CL, SM-SC, SC, CL-ML	A-6, A-4	0-5	85-95	80-95	65-85	40-60	20-35	5-15
	31-60	Gravelly loamy sand, coarse sand.	SW, SM, SP-SM, SP	A-1	2-10	60-90	60-85	20-40	3-25	---	NP
484C---------- Eyota	0-24	Sandy loam------	SM	A-2-4	0	90-100	85-100	60-90	20-35	---	NP
	24-50	Silt loam, loam	CL, CL-ML	A-4	0	100	100	90-100	60-100	20-30	5-10
	50-60	Silt loam, loam, fine sandy loam.	ML	A-4	0	100	100	90-100	50-100	20-30	NP-5
484E---------- Eyota	0-10	Loamy sand------	SM	A-2	0	90-100	85-100	50-90	15-25	---	NP
	10-24	Fine sandy loam	SM	A-2-4	0	90-100	85-100	60-70	20-30	---	NP
	24-50	Silt loam, loam	CL, CL-ML	A-4	0	100	100	90-100	60-100	20-30	5-10
	50-60	Silt loam, loam, fine sandy loam.	ML	A-4	0	100	100	90-100	50-100	20-30	NP-5
485---------- Lawler	0-16	Loam----------	OL, CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-20
	16-33	Loam, sandy clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	33-60	Stratified sandy loam to gravelly coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
486---------- Marshan	0-12	Silt loam, silty clay loam.	ML, CL	A-6, A-4	0	95-100	95-100	95-100	60-90	30-40	5-15
	12-29	Silty clay loam, clay loam, loam.	CL	A-7, A-6	0	95-100	95-100	95-100	80-95	30-50	15-30
	29-60	Coarse sand, gravelly coarse sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
487---------- Hoopeston	0-32	Sandy loam, loam	SM	A-2, A-4	0	90-100	90-100	70-90	25-50	20-35	NP-10
	32-60	Loamy sand, sand	SP-SM, SM, SC, SM-SC	A-2, A-3	0	90-100	90-100	50-80	5-20	<25	NP-10
488F---------- Brodale	0-12	Flaggy loam------	SM, SP-SM, SC, GM	A-2, A-1	7-30	30-65	20-55	15-45	8-35	12-30	NP-8
	12-24	Flaggy very fine sandy loam, flaggy silt loam.	SM, SC, GM, GC	A-2, A-4, A-1, A-6	20-50	30-65	20-55	15-45	12-45	10-35	NP-12
	24-45	Flaggy very fine sandy loam, flaggy silt loam.	SM, SC, SM-SC, GM	A-2, A-1	20-50	45-80	40-75	25-50	10-35	12-30	NP-8
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
488G---------- Brodale	0-12	Flaggy sandy loam.	SM, SP-SM, SC, GM	A-2, A-1	7-30	30-65	20-55	15-45	8-35	12-30	NP-8
	12-24	Very flaggy sandy loam, flaggy silt loam.	SM, SC, GM, GC	A-2, A-4, A-1, A-6	20-50	30-65	20-55	15-45	12-45	10-35	NP-12
	24-45	Very flaggy sandy loam, flaggy silt loam.	SM, SC, SM-SC, GM	A-2, A-1	20-50	45-80	40-75	25-50	10-35	12-30	NP-8
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
489A, 489B---------- Atkinson	0-13	Loam----------	CL	A-6	0	100	95-100	85-95	55-75	25-35	10-20
	13-41	Loam, clay loam, sandy clay loam.	CL	A-6	2-5	90-95	80-95	80-90	50-65	30-40	10-20
	41	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
491B---------- Waucoma	0-12	Loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	65-85	20-30	5-15
	12-55	Loam, sandy clay loam, clay.	CL, SC, CL-ML, SM-SC	A-4, A-6	2-5	90-95	80-95	80-90	45-65	25-40	5-20
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
492B, 492C---------- Nasset	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	6-44	Silt loam, silty clay loam, clay.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
493B, 493C---------- Oronoco	0-11	Loam----------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	60-85	20-40	3-15
	11-74	Fine sandy loam, loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	100	95-100	35-80	15-25	3-10
	74-77	Silt loam--------	ML	A-4	0	100	100	95-100	85-100	25-35	NP-10
493D---------- Oronoco	0-8	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	95-100	35-60	15-30	3-10
	8-43	Fine sandy loam, loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	100	95-100	35-80	15-25	3-10
	43-60	Silt loam--------	ML	A-4	0	100	100	95-100	85-100	25-35	NP-10
495---------- Zumbro	0-25	Loamy sand------	SM	A-2	0	100	95-100	60-95	15-35	<20	NP
	25-48	Sand, fine sand, loamy sand.	SP, SM, SP-SM	A-2, A-3	0	90-100	85-100	60-95	4-30	<20	NP
	48-60	Sand, fine sand, coarse sand.	SP, SM, SP-SM	A-2, A-3	0	80-100	70-100	50-80	4-20	<20	NP
516A, 516B---------- Dowagiac	0-15	Silt loam, loam	ML, CL-ML	A-4	0	95-100	95-100	80-100	60-90	20-35	2-9
	15-21	Clay loam, loam	CL, SC	A-6, A-4	0	95-100	70-95	70-90	45-75	25-38	9-18
	21-35	Sandy loam, coarse sandy loam, gravelly coarse sandy loam.	SM, SM-SC	A-2-4, A-1-b	0	80-100	60-85	40-60	15-30	12-23	2-7
	35-60	Sand, gravelly loamy coarse sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	50-80	25-75	10-55	0-10	---	NP

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
516C---------- Dowagiac	0-7	Sandy loam------	SM, SM-SC	A-2-4	0	95-100	95-100	60-70	15-35	12-23	2-7
	7-15	Clay loam, loam	CL, SC	A-6, A-4	0	95-100	70-95	70-90	45-75	25-38	9-18
	15-45	Sandy loam, coarse sandy loam, gravelly coarse sandy loam.	SM, SM-SC	A-2-4, A-1-b	0	80-100	60-85	40-60	15-30	12-23	2-7
	45-60	Sand, gravelly loamy coarse sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	50-80	25-75	10-55	0-10	---	NP
528B---------- Palms	0-33	Sapric material	Pt	---	---	---	---	---	---	---	---
	33-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
593D, 593E---------- Elbaville	0-16	Silt loam, silt	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	20-30	3-8
	16-20	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	95-100	80-95	30-45	8-20
	20-25	Silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	100	100	95-100	85-95	40-65	20-32
	25-36	Very flaggy silty clay loam, flaggy silt loam.	GC, GM, SC, SM	A-2, A-4, A-6, A-7	20-50	35-75	30-70	25-65	20-50	30-45	5-20
	36-60	Flaggy loamy sand, very flaggy sandy loam, flaggy sand.	GM, SM, GP-GM, SP-SM	A-2, A-1	20-50	35-75	30-70	15-50	10-30	<20	NP-4
898F*:											
Brodale----------	0-8	Flaggy sandy loam.	SM, SP-SM, SC, GM	A-2, A-1	7-30	30-65	20-55	15-45	8-35	12-30	NP-8
	8-18	Flaggy sandy loam, flaggy silt loam.	SM, SC, GM, GC	A-2, A-4, A-1, A-6	20-50	30-65	20-55	15-45	12-45	10-35	NP-12
	18-60	Flaggy loamy fine sand, flaggy silt loam.	SM, SC, SM-SC, GM	A-2, A-1	20-50	45-80	40-75	25-50	10-35	12-30	NP-8
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bellechester------	0-20	Loamy sand------	SP-SM, SM	A-3, A-2	0-10	90-100	85-100	70-90	5-15	<20	NP
	20-48	Sand, fine sand, loamy sand.	SP, SP-SM	A-3	0-45	85-100	70-100	50-90	3-10	<20	NP
	48	Weathered bedrock.	---	---	---	---	---	---	---	---	---
973D*:											
Brodale----------	0-7	Flaggy loam------	SM, SP-SM, SC, GM	A-2, A-1	7-30	30-65	20-55	15-45	8-35	12-30	NP-8
	7-12	Flaggy very fine sandy loam, very flaggy loam.	SM, SC, GM, GC	A-2, A-4, A-1, A-6	20-50	30-65	20-55	15-45	12-45	10-35	NP-12
	12-45	Flaggy very fine sandy loam, channery loamy fine sand.	SM, SC, SM-SC, GM	A-2, A-1	20-50	45-80	40-75	25-50	10-35	12-30	NP-8
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
973D*:											
Sogn	0-15	Loam	CL	A-6	0-10	85-100	85-100	85-100	70-95	25-40	11-23
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
1013*. Pits											
1029*. Pits											
1039*. Urban land											
1078*. Udorthents											
1811B*:											
Lamont	0-8	Sandy loam	SM-SC, SC	A-2, A-4	0	100	100	80-95	25-50	15-25	5-10
	8-28	Sandy loam, loam, sandy clay loam.	SM-SC, SC	A-2, A-4	0	100	100	85-95	30-50	20-30	5-10
	28-60	Loamy fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
Racine	0-8	Loam	ML	A-4, A-6	0	95-100	95-100	90-100	55-85	30-40	5-14
	8-22	Silt loam, clay loam, silty clay loam.	CL	A-6	0	95-100	95-100	90-100	55-85	30-40	10-20
	22-42	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-2, A-6	0-3	85-100	75-95	65-90	30-85	20-40	NP-15
	42-60	Loam	ML, CL, SM, SC	A-4, A-6	0-3	85-100	80-95	70-90	35-75	20-40	3-20
1812B	0-31	Loam	CL	A-4, A-6	0-5	100	95-100	70-90	60-80	25-40	8-15
Terril	31-45	Loam, clay loam	CL	A-4, A-6	0-5	100	90-100	70-90	60-80	25-40	8-15
	45-60	Coarse sand, gravelly sand.	SP-SM, SM	A-2-4	0-25	90-100	75-90	60-80	10-35	---	NP
1819G*:											
Dorerton	0-11	Loam	ML	A-4	0	100	100	70-95	55-90	20-30	NP-5
	11-18	Loam, clay loam	CL, ML	A-4, A-6	0-5	95-100	85-100	70-95	50-85	30-40	5-15
	18-25	Channery loam, very channery clay loam, very channery loam.	GM, GC, SM, SC	A-2, A-1	20-55	40-75	30-65	20-45	12-35	30-45	5-20
	25-60	Very channery loam, very flaggy loam, flaggy loamy sand.	GW-GM, SP-SM, SM	A-1, A-2	20-55	40-75	30-65	15-40	5-30	<20	NP
Rock outcrop.											
1832C*:											
Ostrander	0-13	Loam	CL-ML, CL	A-4, A-6	0	100	98-100	90-95	70-90	25-40	5-15
	13-20	Loam, silt loam	CL, CL-ML	A-4	0-1	95-100	98-100	90-95	70-90	25-40	5-15
	20-45	Loam, sandy clay loam, sandy loam.	CL, SC	A-6	0-2	95-100	75-98	65-90	45-65	25-35	10-15
	45-60	Loam	CL	A-6	0-1	95-100	90-98	80-95	50-75	25-40	10-20
Dowagiac	0-10	Loam	ML, CL-ML	A-4	0	95-100	95-100	80-100	60-90	20-35	2-9
	10-19	Clay loam, loam	CL, SC	A-6, A-4	0	95-100	70-95	70-90	45-75	25-38	9-18
	19-34	Loamy sand, coarse sandy loam, gravelly sandy loam.	SM, SM-SC	A-2-4, A-1-b	0	80-100	60-85	40-60	15-30	12-23	2-7
	34-60	Sand, gravelly coarse sand, coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	50-80	25-75	10-55	0-10	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
1846---------- Kato	0-16	Silty clay loam	CL, ML	A-6, A-7, A-4	0	100	95-100	90-95	70-95	35-50	8-23
	16-50	Silty clay loam, silt loam.	ML, CL	A-6, A-7, A-4	0	100	95-100	90-95	70-95	35-50	8-23
	50-60	Sand, coarse sand, gravelly loamy coarse sand.	SP, SW, SP-SM, SW-SM	A-1, A-3, A-2	0-5	75-100	70-95	25-70	2-12	<20	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
2A	0-17	18-27	1.45-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.28	5	6	4-6
Ostrander	17-38	18-27	1.45-1.55	0.6-2.0	0.17-0.20	5.1-7.3	Low	0.28			
	38-50	13-27	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.28			
	50-60	18-27	1.60-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.37			
2B	0-14	18-27	1.45-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.28	5	6	4-6
Ostrander	14-18	18-27	1.45-1.55	0.6-2.0	0.17-0.20	5.1-7.3	Low	0.28			
	18-40	13-27	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.28			
	40-70	18-27	1.60-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.37			
11C	0-8	18-25	1.15-1.20	0.6-2.0	0.17-0.22	6.1-8.4	Moderate	0.28	1	4L	3-4
Sogn	8	---	---	---	---	---	---	---			
16	0-31	5-15	1.20-1.55	0.6-2.0	0.20-0.24	5.6-7.8	Low	0.37	5	5	2-3
Arenzville	31-60	5-20	1.25-1.45	0.6-2.0	0.18-0.22	5.6-7.8	Moderate	0.37			
19	0-60	12-16	1.35-1.55	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.37	5	5	2-3
Chaseburg											
23	0-11	20-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-6.5	Moderate	0.37	5	6	2-4
Skyberg	11-24	24-32	1.35-1.45	0.6-2.0	0.18-0.20	4.5-5.5	Moderate	0.37			
	24-46	20-27	1.75-1.85	0.06-0.6	0.14-0.19	5.1-7.3	Moderate	0.37			
	46-70	20-27	1.75-1.85	0.06-0.6	0.13-0.19	5.6-7.8	Moderate	0.37			
24	0-9	18-27	1.45-1.55	0.6-2.0	0.22-0.24	5.6-6.5	Low	0.32	5	5	2-4
Kasson	9-22	24-32	1.45-1.55	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.32			
	22-60	20-32	1.70-1.80	0.2-0.6	0.15-0.19	5.1-8.4	Moderate	0.32			
25	0-30	10-18	1.40-1.50	2.0-6.0	0.20-0.22	5.6-7.3	Low	0.20	4	5	4-5
Becker	30-36	2-10	1.55-1.65	6.0-20	0.05-0.10	6.1-7.8	Low	0.15			
	36-60	1-10	1.60-1.70	6.0-20	0.02-0.07	6.6-7.8	Low	0.15			
27A, 27B, 27C	0-15	12-18	1.50-1.55	2.0-6.0	0.12-0.15	5.6-7.3	Low	0.20	4	3	2-4
Dickinson	15-28	10-15	1.45-1.55	2.0-6.0	0.12-0.15	5.6-6.5	Low	0.20			
	28-60	5-10	1.60-1.70	6.0-20	0.02-0.04	5.6-6.5	Low	0.15			
30B	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	4-5
Kenyon	13-50	20-28	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low	0.28			
	50-65	20-24	1.65-1.80	0.2-0.6	0.17-0.19	6.6-7.8	Low	0.37			
42E	0-6	5-15	1.35-1.45	2.0-6.0	0.10-0.12	6.1-8.4	Low	0.10	3	8	2-3
Salida	6-12	2-8	1.50-1.65	>20	0.02-0.04	7.4-8.4	Low	0.10			
	12-60	0-5	1.50-1.65	>20	0.02-0.04	7.4-8.4	Low	0.10			
73F	0-20	4-8	1.45-1.55	6.0-20	0.10-0.14	6.1-8.4	Low	0.15	5	2	1-2
Bellechester	20-43	2-8	1.50-1.65	6.0-20	0.04-0.08	6.6-8.4	Low	0.15			
	43	---	---	---	---	---	---	---			
99B, 99C, 99D2	0-12	18-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.32	5	6	2-4
Racine	12-18	22-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Moderate	0.32			
	18-46	18-32	1.55-1.65	0.6-2.0	0.15-0.19	4.5-6.0	Low	0.32			
	46-65	18-27	1.65-1.80	0.6-2.0	0.16-0.19	6.6-7.8	Moderate	0.32			
131B, 131C, 131D	0-7	18-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.32	4	6	2-4
Massbach	7-37	24-30	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.8	Moderate	0.43			
	37-45	27-45	1.30-1.60	<0.06	0.11-0.18	6.1-7.8	Moderate	0.32			
	45-60	---	---	---	---	---	---	---			
143B, 143C	0-9	5-15	1.40-1.70	2.0-6.0	0.13-0.18	5.1-7.3	Low	0.24	4	3	1-2
Eleva	9-21	10-18	1.50-1.70	0.6-6.0	0.12-0.19	5.1-6.5	Low	0.24			
	21-32	1-8	1.55-1.70	2.0-20	0.05-0.10	5.1-6.5	Low	0.15			
	32	---	---	---	---	---	---	---			

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
173F----------	0-14	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.32	4	3	4-5
Frontenac	14-27	18-27	1.40-1.50	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.32			
	27-60	5-10	---	2.0-6.0	0.04-0.10	6.6-7.8	Low----------	0.24			
176----------	0-13	30-35	1.30-1.35	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7	6-7
Garwin	13-33	28-34	1.28-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28			
	33-65	20-26	1.35-1.45	0.6-2.0	0.20-0.22	6.6-7.8	Moderate-----	0.28			
203----------	0-20	18-27	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.28	5	6	4-6
Joy	20-40	18-27	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.43			
	40-65	14-18	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.43			
209A, 209B-------	0-12	12-18	1.35-1.55	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	4	5	2-4
Kegonsa	12-25	20-35	1.55-1.65	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.43			
	25-29	15-35	1.55-1.65	0.6-2.0	0.15-0.19	6.1-7.8	Low----------	0.43			
	29-60	0-2	1.30-2.20	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
216B----------	0-13	10-15	1.50-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low----------	0.24	5	3	.5-1
Lamont	13-20	10-22	1.45-1.65	2.0-6.0	0.14-0.16	5.1-7.3	Low----------	0.24			
	20-75	2-10	1.65-1.75	>20	0.09-0.11	5.1-6.5	Low----------	0.17			
244C----------	0-13	8-15	1.50-1.55	6.0-20	0.11-0.13	5.1-7.3	Low----------	0.20	2	3	<1
Lilah	13-56	2-10	1.55-1.80	>20	0.02-0.04	4.5-7.3	Very low-----	0.20			
	56-70	2-6	1.55-1.85	>20	0.02-0.04	4.5-7.3	Very low-----	0.20			
251F, 251G-------	0-10	18-27	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.24	2	6	2-3
Marlean	10-60	10-27	1.40-1.50	2.0-6.0	0.08-0.15	7.4-7.8	Very low-----	0.24			
252----------	0-14	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	4	6	4-8
Marshan	14-23	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28			
	23-30	18-30	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.28			
	30-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15			
283B----------	0-10	5-15	1.35-1.65	2.0-6.0	0.09-0.12	4.5-7.3	Low----------	0.17	5	2	<1
Plainfield	10-60	1-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.0	Low----------	0.17			
283C----------	0-6	4-9	1.35-1.65	6.0-20	0.04-0.09	4.5-7.3	Low----------	0.17	5	1	<1
Plainfield	6-60	1-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.0	Low----------	0.17			
283E----------	0-8	4-9	1.35-1.65	6.0-20	0.04-0.09	4.5-7.3	Low----------	0.17	5	1	<1
Plainfield	8-60	1-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.0	Low----------	0.17			
285A, 285B, 285C-	0-15	18-27	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5-4	6	2-6
Port Byron	15-60	16-25	1.30-1.45	0.6-2.0	0.20-0.22	5.6-8.4	Low----------	0.43			
289----------	0-29	14-20	1.25-1.30	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.28	5	6	4-5
Radford	29-72	22-28	1.25-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate-----	0.28			
295----------	0-22	18-24	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.24	5	6	4-6
Readlyn	22-44	22-28	1.45-1.70	0.6-2.0	0.17-0.19	5.1-6.5	Low----------	0.32			
	44-65	18-24	1.70-1.80	0.2-0.6	0.17-0.19	6.6-7.8	Low----------	0.32			
298----------	0-24	15-22	1.35-1.60	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.28	5	5	4-6
Richwood	24-50	18-34	1.55-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.43			
	50-59	10-20	1.55-1.65	0.6-6.0	0.10-0.22	5.6-7.3	Low----------	0.43			
	59-70	1-4	1.55-1.65	6.0-20	0.05-0.07	6.1-7.3	Low----------	0.15			
299A, 299B, 299C-	0-15	18-28	1.30-1.40	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.28	4	6	4-6
Rockton	15-26	25-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Moderate-----	0.28			
	26-31	35-60	1.35-1.45	0.6-2.0	0.10-0.14	5.6-7.3	High---------	0.28			
	31	---	---	---	---	---	----------	----			
301B, 301C-------	0-31	18-24	1.20-1.30	0.6-2.0	0.22-0.26	5.6-7.3	Low----------	0.32	5	5	4-6
Lindstrom	31-44	18-24	1.30-1.40	0.6-2.0	0.20-0.22	5.6-6.5	Low----------	0.43			
	44-60	12-20	1.40-1.50	0.6-2.0	0.17-0.19	6.6-7.8	Low----------	0.43			

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
309C, 309D------- Schapville	0-7	27-35	1.25-1.30	0.6-2.0	0.18-0.20	5.6-7.8	Moderate-----	0.32	2	7	2-4
	7-15	27-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.8	Moderate-----	0.32			
	15-20	40-60	1.50-1.60	0.06-0.2	0.08-0.10	5.6-7.8	Moderate-----	0.32			
	20-60	---	---	<0.06	0.04-0.06	7.4-8.4	Moderate-----	----			
312B, 312C------- Shullsburg	0-17	22-35	1.40-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	4	6	4-7
	17-26	24-35	1.40-1.50	0.2-0.6	0.18-0.22	5.6-7.3	Moderate-----	0.32			
	26-37	40-70	1.50-1.60	0.06-0.2	0.12-0.16	6.1-7.8	High---------	0.32			
	37-60	---	---	---	---	---	----------	----			
313-------------- Spillville	0-60	18-26	1.45-1.55	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6	4-6
	60-70	14-24	1.55-1.70	0.6-6.0	0.15-0.18	5.6-7.3	Low----------	0.28			
322C, 322D, 322E- Timula	0-60	10-18	1.40-1.50	0.6-2.0	0.20-0.24	6.1-8.4	Low----------	0.37	5-4	5	---
333-------------- Vasa	0-14	15-22	1.35-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	7	2-3
	14-38	20-27	1.40-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.43			
	38-60	15-22	1.40-1.50	0.6-2.0	0.20-0.22	6.6-7.3	Low----------	0.43			
340B, 340C------- Whalan	0-17	18-25	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	4	6	1-2
	17-22	18-35	1.40-1.55	0.6-2.0	0.17-0.19	5.1-6.5	Low----------	0.32			
	22-27	35-60	1.35-1.45	0.6-2.0	0.15-0.19	5.6-7.8	High---------	0.32			
	27	---	---	---	---	---	----------	----			
369B, 369C------- Waubeek	0-13	19-24	1.25-1.30	2.0-6.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5-4	6	2-3
	13-33	26-34	1.25-1.35	0.6-2.0	0.18-0.20	5.1-6.0	Moderate-----	0.43			
	33-70	20-28	1.65-1.80	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.43			
378-------------- Maxfield	0-15	30-35	1.35-1.40	0.6-2.0	0.21-0.23	6.1-7.3	High---------	0.24	5	6	6-8
	15-32	28-34	1.40-1.50	0.6-2.0	0.18-0.20	5.6-7.3	High---------	0.32			
	32-60	20-26	1.65-1.85	0.6-2.0	0.17-0.19	6.1-7.8	Low----------	0.32			
401B, 401C, 401C2, 401D, 401D2, 401E----- Mt. Carroll	0-12	16-24	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5-4	6	.5-4
	12-51	18-29	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
	51-60	12-18	1.35-1.45	0.6-2.0	0.20-0.22	5.6-8.4	Low----------	0.43			
463-------------- Minneiska	0-39	10-18	1.35-1.45	2.0-6.0	0.20-0.22	7.4-8.4	Low----------	0.28	5	5	4-5
	39-60	5-18	1.55-1.65	2.0-6.0	0.13-0.18	7.4-8.4	Low----------	0.28			
465-------------- Kalmarville	0-43	13-18	1.35-1.45	0.6-2.0	0.20-0.24	6.6-7.8	Low----------	0.28	5	8	2-4
	43-60	2-5	1.55-1.65	6.0-20	0.06-0.09	6.6-7.8	Low----------	0.10			
467-------------- Sawmill	0-41	27-35	1.25-1.30	0.2-2.0	0.18-0.23	6.1-7.8	Moderate-----	0.28	5	7	4-5
	41-65	20-35	1.30-1.40	0.2-2.0	0.11-0.20	7.4-8.4	Moderate-----	0.28			
468-------------- Otter	0-22	16-30	1.25-1.30	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.28	5	6	5-6
	22-65	15-30	1.30-1.40	0.6-2.0	0.12-0.21	6.6-8.4	Low----------	0.28			
471-------------- Root	0-34	5-8	1.25-1.45	0.6-2.0	0.20-0.24	6.6-7.8	Low----------	0.32	4	6	3-4
	34-50	5-18	---	>20	0.01-0.02	7.4-7.8	Low----------	----			
472B, 472C------- Channahon	0-12	18-27	1.25-1.40	0.6-2.0	0.20-0.24	6.1-8.4	Low----------	0.37	2-1	6	2-3
	12-15	25-30	1.40-1.45	0.6-2.0	0.15-0.22	6.1-8.4	Moderate-----	0.37			
	15	---	---	---	---	---	----------	----			
473D, 473F------- Dorerton	0-10	10-18	1.30-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.32	2	5	1-2
	10-18	18-35	1.30-1.45	0.6-2.0	0.17-0.19	5.1-6.0	Low----------	0.32			
	18-30	20-35	---	0.6-2.0	0.08-0.14	5.6-6.5	Low----------	0.24			
	30-60	2-25	---	2.0-6.0	0.03-0.09	7.4-7.8	Low----------	0.10			
474B------------- Haverhill	0-13	40-50	1.25-1.35	0.06-0.2	0.13-0.17	7.4-7.8	High---------	0.37	4	8	4-6
	13-32	40-50	1.25-1.40	0.06-0.2	0.09-0.16	7.4-7.8	High---------	0.37			
	32	---	---	---	---	---	----------				

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
475B----------	0-9	8-18	1.50-1.55	2.0-6.0	0.12-0.14	6.6-7.3	Low----------	0.24	4	3	2-3
Backbone	9-23	12-18	1.55-1.65	2.0-6.0	0.11-0.13	5.1-7.3	Low----------	0.24			
	23-28	36-42	1.65-1.80	2.0-6.0	0.14-0.16	5.6-7.3	High---------	0.24			
	28	---	---	---	---	---	----------	----			
476B, 476C-------	0-12	10-18	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	4	6	1-3
Frankville	12-37	18-30	1.30-1.40	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.43			
	37	---	---	---	---	---	----------	----			
477A, 477B-------	0-40	18-27	1.25-1.30	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6	4-6
Littleton	40-71	16-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.43			
478B----------	0-12	20-24	1.45-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Low----------	0.32	5-4	6	1-2
Coggon	12-55	22-28	1.50-1.70	0.2-0.6	0.17-0.19	4.5-6.0	Low----------	0.32			
	55-65	18-24	1.70-1.80	0.2-0.6	0.17-0.19	5.1-7.8	Low----------	0.32			
479----------	0-8	20-26	1.35-1.40	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.24	5	6	5-7
Floyd	8-26	18-24	1.40-1.60	0.6-2.0	0.16-0.18	5.6-7.3	Low----------	0.32			
	26-65	18-24	1.65-1.80	0.6-2.0	0.16-0.18	6.6-7.8	Low----------	0.32			
483A, 483B-------	0-10	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	4	6	4-5
Waukee	10-31	18-26	1.40-1.50	0.6-2.0	0.15-0.19	4.5-6.5	Low----------	0.32			
	31-60	2-8	1.50-1.75	>20	0.02-0.06	5.6-7.3	Low----------	0.10			
484C----------	0-24	5-15	1.45-1.60	2.0-6.0	0.13-0.15	6.1-7.8	Low----------	0.20	5	3	2-3
Eyota	24-50	15-25	1.35-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.43			
	50-60	10-18	1.40-1.50	0.6-2.0	0.14-0.20	6.6-7.3	Low----------	0.43			
484E----------	0-10	0-5	1.50-1.60	2.0-6.0	0.10-0.12	6.1-7.8	Low----------	0.20	5	2	2-3
Eyota	10-24	0-15	1.50-1.60	2.0-6.0	0.10-0.12	6.1-7.8	Low----------	0.20			
	24-50	15-25	1.35-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.43			
	50-60	10-18	1.40-1.50	0.6-2.0	0.14-0.20	6.6-7.3	Low----------	0.43			
485----------	0-16	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	4	6	4-5
Lawler	16-33	20-26	1.45-1.60	0.6-2.0	0.16-0.18	5.6-6.5	Low----------	0.28			
	33-60	2-12	1.60-1.75	6.0-20	0.02-0.04	6.1-6.5	Low----------	0.10			
486----------	0-12	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	4	6	4-8
Marshan	12-29	25-35	1.40-1.55	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.28			
	29-60	<5	1.55-1.65	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15			
487----------	0-32	8-18	1.40-1.50	2.0-6.0	0.12-0.15	5.1-6.5	Low----------	0.28	4	3	4-6
Hoopeston	32-60	2-10	1.50-1.60	6.0-20	0.05-0.10	5.6-7.8	Low----------	0.28			
488F, 488G-------	0-12	5-15	1.45-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Low----------	0.20	2	8	2-4
Brodale	12-24	5-15	1.50-1.65	0.6-2.0	0.06-0.12	7.4-8.4	Low----------	0.20			
	24-45	5-15	1.50-1.65	0.6-2.0	0.04-0.09	7.9-8.4	Low----------	0.20			
	45	---	---	---	---	---	----------	----			
489A, 489B-------	0-13	18-24	1.40-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	4	6	4-5
Atkinson	13-41	24-29	1.45-1.75	0.6-2.0	0.17-0.19	5.6-6.5	Low----------	0.28			
	41	---	---	---	---	---	----------	----			
491B----------	0-12	18-24	1.45-1.50	0.6-2.0	0.19-0.21	5.6-7.3	Low----------	0.28	4	6	2-3
Waucoma	12-55	20-27	1.50-1.70	0.6-2.0	0.17-0.19	5.6-6.5	Low----------	0.28			
	55	---	---	---	---	---	----------	----			
492B, 492C-------	0-6	18-24	1.25-1.30	0.6-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	4-3	6	2-3
Nasset	6-44	26-34	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	44	---	---	---	---	---	----------	----			

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm³	In/hr	In/in	pH					Pct
493B, 493C------- Oronoco	0-11 11-74 74-77	10-20 5-18 5-18	1.35-1.45 1.40-1.50 1.40-1.50	0.6-2.0 0.6-2.0 0.6-2.0	0.20-0.22 0.15-0.19 0.20-0.22	6.1-7.3 5.6-7.8 7.4-7.8	Low---------- Low---------- Low----------	0.32 0.32 0.43	5-4	5	3-6
493D------------- Oronoco	0-8 8-43 43-60	5-15 5-18 5-18	1.40-1.50 1.40-1.50 1.40-1.50	2.0-6.0 0.6-2.0 0.6-2.0	0.15-0.18 0.15-0.19 0.20-0.22	6.1-7.3 5.6-7.8 7.4-7.8	Low---------- Low---------- Low----------	0.24 0.32 0.43	5-4	3	1-2
495-------------- Zumbro	0-25 25-48 48-60	2-10 0-10 0-5	1.45-1.55 1.45-1.60 1.55-1.65	6.0-20 6.0-20 6.0-20	0.10-0.12 0.05-0.12 0.05-0.08	5.6-7.8 6.1-7.8 6.1-7.8	Low---------- Low---------- Low----------	0.17 0.17 0.17	5	2	2-4
516A, 516B------- Dowagiac	0-15 15-21 21-35 35-60	7-25 27-35 5-20 0-10	1.10-1.64 1.22-1.87 1.22-1.87 1.48-1.67	0.6-2.0 0.6-2.0 2.0-6.0 6.0-20	0.16-0.18 0.13-0.14 0.14-0.15 0.01-0.04	5.6-7.3 5.1-7.3 5.1-6.5 5.6-7.3	Low---------- Moderate----- Low---------- Low----------	0.28 0.28 0.28 0.15	4	5	2-3
516C------------- Dowagiac	0-7 7-15 15-45 45-60	0-20 27-35 5-20 0-10	1.10-1.64 1.22-1.87 1.22-1.87 1.48-1.67	2.0-6.0 0.6-2.0 2.0-6.0 6.0-20	0.14-0.16 0.13-0.14 0.14-0.15 0.01-0.04	5.6-7.3 5.1-7.3 5.1-6.5 5.6-7.3	Low---------- Moderate----- Low---------- Low----------	0.20 0.28 0.28 0.15	4	3	2-3
528B------------- Palms	0-33 33-60	--- 7-35	0.25-0.45 1.46-2.00	0.2-6.0 0.2-2.0	0.35-0.45 0.14-0.22	5.1-8.4 6.1-8.4	---------- Low----------	---- ----	---	3	>75
593D, 593E------- Elbaville	0-16 16-20 20-25 25-36 36-60	10-28 24-35 35-50 20-35 5-18	1.35-1.50 1.35-1.50 1.25-1.35 --- ---	0.6-2.0 0.2-0.6 0.2-0.6 0.6-2.0 2.0-6.0	0.20-0.24 0.16-0.19 0.13-0.16 0.12-0.14 0.06-0.10	5.6-7.3 5.6-7.3 5.6-7.3 5.6-7.8 7.4-8.4	Low---------- Moderate----- Moderate----- Moderate----- Low----------	0.32 0.32 0.32 0.24 0.10	4	5	1-2
898F*: Brodale--------- Bellechester---- 973D*: Brodale--------- Sogn------------ 1013*. Pits 1029*. Pits 1039*. Urban land 1078*. Udorthents 1811B*: Lamont---------- 	0-8 8-18 18-60 60 0-20 20-48 48 0-7 7-12 12-45 45 0-15 15	5-15 5-15 5-15 --- 4-8 2-8 --- 5-15 5-15 5-15 --- 18-25 --- 10-15 10-22 2-10	1.45-1.60 1.50-1.65 1.50-1.65 --- 1.45-1.55 1.50-1.65 --- 1.45-1.60 1.50-1.65 1.50-1.65 --- 1.15-1.20 --- 1.50-1.55 1.45-1.65 1.65-1.75	0.6-2.0 0.6-2.0 0.6-2.0 --- 6.0-20 6.0-20 --- 0.6-2.0 0.6-2.0 0.6-2.0 --- 0.6-2.0 --- 2.0-6.0 2.0-6.0 >20	0.06-0.12 0.06-0.12 0.04-0.09 --- 0.10-0.14 0.04-0.08 --- 0.06-0.12 0.06-0.12 0.04-0.09 --- 0.17-0.22 --- 0.16-0.18 0.14-0.16 0.09-0.11	7.4-8.4 7.4-8.4 7.9-8.4 --- 6.1-8.4 6.6-8.4 --- 7.4-8.4 7.4-8.4 7.9-8.4 --- 6.1-8.4 --- 5.1-7.3 5.1-6.0 5.1-6.5	Low---------- Low---------- Low---------- ---------- Low---------- Low---------- ---------- Low---------- Low---------- Low---------- ---------- Moderate----- ---------- Low---------- Low---------- Low----------	0.20 0.20 0.20 ---- 0.15 0.15 ---- 0.20 0.20 0.20 ---- 0.28 ---- 0.24 0.24 0.17	2 5 2 1 5 	8 2 8 4L 3 	2-4 2-3 2-4 3-4 5-2

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
1811B*:											
Racine----------	0-8	18-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.32	5	6	2-4
	8-22	22-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Moderate-----	0.32			
	22-42	18-32	1.55-1.65	0.6-2.0	0.15-0.19	4.5-6.0	Low----------	0.32			
	42-60	18-27	1.65-1.80	0.6-2.0	0.16-0.19	6.6-7.8	Moderate-----	0.32			
1812B----------	0-31	20-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.32	5	6	4-5
Terril	31-45	27-32	1.40-1.65	0.6-2.0	0.16-0.18	6.6-7.3	Low----------	0.32			
	45-60	2-8	1.65-1.75	6.0-20	0.05-0.07	6.6-8.4	Low----------	0.10			
1819G*:											
Dorerton--------	0-11	10-18	1.30-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.32	2	5	1-2
	11-18	18-35	1.30-1.45	0.6-2.0	0.17-0.19	5.1-6.0	Low----------	0.32			
	18-25	20-35	---	0.6-2.0	0.08-0.14	5.6-6.5	Low----------	0.24			
	25-60	2-25	---	2.0-6.0	0.03-0.09	7.4-7.8	Low----------	0.10			
Rock outcrop.											
1832C*:											
Ostrander-------	0-13	18-27	1.45-1.55	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	6	3-5
	13-20	18-27	1.45-1.55	0.6-2.0	0.17-0.20	5.1-7.3	Low----------	0.28			
	20-45	13-27	1.45-1.65	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.28			
	45-60	18-27	1.60-1.80	0.6-2.0	0.17-0.19	6.6-7.8	Low----------	0.37			
Dowagiac--------	0-10	7-25	1.10-1.64	0.6-2.0	0.16-0.18	5.6-6.5	Low----------	0.28	4	5	1-3
	10-19	27-35	1.22-1.87	0.6-2.0	0.13-0.14	5.1-6.5	Moderate-----	0.28			
	19-34	5-20	1.22-1.87	2.0-6.0	0.14-0.15	5.1-6.5	Low----------	0.28			
	34-60	0-10	1.48-1.67	6.0-20	0.01-0.04	5.6-7.3	Low----------	0.15			
1846----------	0-16	24-35	1.25-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Moderate-----	0.28	4	6	5-10
Kato	16-50	24-35	1.30-1.40	0.6-2.0	0.18-0.22	5.6-7.8	Moderate-----	0.28			
	50-60	<5	1.55-1.65	6.0-20	0.02-0.07	6.6-7.8	Low----------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
2A, 2B---------- Ostrander	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
11C---------- Sogn	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low------	Low.
16---------- Arenzville	B	Frequent----	Brief-----	Nov-Jun	3.0-6.0	Apparent	Nov-Jun	>60	---	High-----	Moderate	Moderate.
19---------- Chaseburg	B	Frequent----	Very brief	Nov-Jun	3.0-6.0	---	---	>60	---	High-----	Moderate	Moderate.
23---------- Skyberg	C	None--------	---	---	1.0-3.0	Perched	Apr-Jun	>60	---	High-----	High-----	Moderate.
24---------- Kasson	C	None--------	---	---	2.0-3.0	Perched	Nov-May	>60	---	High-----	High-----	Moderate.
25---------- Becker	B	Rare--------	---	---	4.0-6.0	Apparent	Nov-May	>60	---	Moderate	Low------	Low.
27A, 27B, 27C----- Dickinson	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
30B---------- Kenyon	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
42E---------- Salida	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
73F---------- Bellechester	A	None--------	---	---	>6.0	---	---	40-70	Rippable	Low------	Low------	Moderate.
99B, 99C, 99D2---- Racine	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
131B---------- Massbach	B	None--------	---	---	3.0-5.0	Perched	Feb-Jun	40-60	Rippable	High-----	High-----	Moderate.
131C, 131D-------- Massbach	B	None--------	---	---	>6.0	---	---	40-60	Rippable	High-----	High-----	Moderate.
143B, 143C-------- Eleva	B	None--------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low------	Moderate.
173F---------- Frontenac	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
176---------- Garwin	B/D	None--------	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
203---------- Joy	B	None--------	---	---	2.0-4.0	Apparent	Apr-Jun	>60	---	High-----	High-----	Moderate.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
209A, 209B-------- Kegonsa	B	None---------	---	---	>6.0	---	---	>60	---	High------	Low-------	Moderate.
216B-------------- Lamont	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Moderate.
244C-------------- Lilah	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	High.
251F, 251G-------- Marlean	B	None---------	---	---	>6.0	---	---	8-18	Rippable	Low-------	Low-------	Low.
252--------------- Marshan	B/D	Rare---------	---	---	1.0-2.5	Apparent	Oct-Jun	>60	---	High------	High------	Moderate.
283B, 283C, 283E-- Plainfield	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	High.
285A, 285B, 285C-- Port Byron	B	None---------	---	---	>6.0	---	---	>60	---	High------	Low-------	Moderate.
289--------------- Radford	B	Occasional	Brief------	Mar-Jun	1.0-3.0	Apparent	Mar-Jun	>60	---	High------	High------	Low.
295--------------- Readlyn	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High------	High------	Moderate.
298--------------- Richwood	B	Rare---------	---	---	>6.0	---	---	>60	---	High------	Low-------	Low.
299A, 299B, 299C-- Rockton	B	None---------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low-------	Low.
301B, 301C-------- Lindstrom	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	Moderate.
309C, 309D-------- Schapville	C	None---------	---	---	>6.0	---	---	20-40	Rippable	Moderate	High------	Moderate.
312B, 312C-------- Shullsburg	C	None---------	---	---	1.0-3.0	Perched	Nov-May	20-40	Rippable	High------	Moderate	Low.
313--------------- Spillville	B	Occasional	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High------	Moderate.
322C, 322D, 322E-- Timula	B	None---------	---	---	>6.0	---	---	>60	---	High------	Low-------	Low.
333--------------- Vasa	B	None---------	---	---	2.0-4.0	Apparent	Nov-May	>60	---	High------	Moderate	Low.
340B, 340C-------- Whalan	B	None---------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate	Low.
369B, 369C-------- Waubeek	B	None---------	---	---	>6.0	---	---	>60	---	High------	Moderate	Moderate.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
378--- Maxfield	B/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
401B, 401C, 401C2, 401D, 401D2, 401E--- Mt. Carroll	B	None	---	---	>6.0	---	---	>60	---	High	Low	Moderate.
463--- Minneiska	B	Occasional	Brief	Mar-Jul	3.0-6.0	Apparent	Mar-Jun	>60	---	Moderate	Low	Low.
465--- Kalmarville	B/D	Frequent	Brief	Feb-Jun	0-1.0	Apparent	Mar-Aug	>60	---	High	Moderate	Low.
467--- Sawmill	B/D	Frequent	Brief	Mar-Jun	0-2.0	Apparent	Mar-Jun	>60	---	High	High	Low.
468--- Otter	B/D	Frequent	Brief	Apr-Jun	0-2.0	Apparent	Apr-Jun	>60	---	High	High	Low.
471--- Root	B/D	Frequent	Very brief	Mar-Jun	0-1.5	Apparent	Jan-Dec	>60	---	High	Moderate	Low.
472B, 472C--- Channahon	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate	Low.
473D, 473F--- Dorerton	B	None	---	---	>6.0	---	---	45-70	Rippable	Low	Low	Moderate.
474B--- Haverhill	D	None	---	---	0-1.0	Perched	Apr-Sep	20-40	Rippable	High	High	Low.
475B--- Backbone	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Low	Low.
476B, 476C--- Frankville	B	None	---	---	>6.0	---	---	20-40	Hard	High	Moderate	Moderate.
477A--- Littleton	B	Rare	---	---	1.0-3.0	Apparent	Apr-Jun	>60	---	High	High	Low.
477B--- Littleton	B	None	---	---	1.0-3.0	Apparent	Apr-Jun	>60	---	High	High	Low.
478B--- Coggon	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
479--- Floyd	B	None	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	High	High	Low.
483A, 483B--- Waukee	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
484C, 484E--- Eyota	A	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
485---------- Lawler	B	None--------	---	---	2.0-4.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
486---------- Marshan	B/D	Frequent----	Brief-----	Mar-Nov	0-1.0	Apparent	Jan-Dec	>60	---	High-----	High-----	Moderate.
487---------- Hoopeston	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High-----	Low------	Moderate.
488F, 488G-------- Brodale	C	None--------	---	---	>6.0	---	---	40-60	Rippable	Moderate	Low------	Low.
489A, 489B-------- Atkinson	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
491B---------- Waucoma	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
492B, 492C-------- Nasset	B	None--------	---	---	>6.0	---	---	40-60	Hard	High-----	Moderate	Moderate.
493B, 493C, 493D-- Oronoco	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
495---------- Zumbro	A	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
516A, 516B, 516C-- Dowagiac	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
528B---------- Palms	A/D	None--------	Long------	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
593D, 593E-------- Elbaville	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
898F*:												
Brodale----------	C	None--------	---	---	>6.0	---	---	40-60	Rippable	Moderate	Low------	Low.
Bellechester-----	A	None--------	---	---	>6.0	---	---	40-70	Rippable	Low------	Low------	Moderate.
973D*:												
Brodale----------	C	None--------	---	---	>6.0	---	---	40-60	Rippable	Moderate	Low------	Low.
Sogn----------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low------	Low.
1013*. Pits												
1029*. Pits												
1039*. Urban land												

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1078*. Udorthents												
1811B*:												
Lamont	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
Racine	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
1812B--- Terril	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
1819G*:												
Dorerton	B	None	---	---	>6.0	---	---	45-70	Rippable	Low	Low	Moderate.
Rock outcrop.												
1832C*:												
Ostrander	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Dowagiac	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
1846--- Kato	B/D	Occasional	Brief	Mar-Jun	0-1.0	Apparent	Jan-Dec	>60	---	High	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Arenzville	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Atkinson	Fine-loamy, mixed, mesic Typic Argiudolls
Backbone	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Becker	Coarse-loamy, mixed, mesic Typic Hapludolls
Bellechester	Sandy, mixed, mesic Entic Hapludolls
Brodale	Loamy-skeletal, carbonatic, mesic Entic Hapludolls
Channahon	Loamy, mixed, mesic Lithic Argiudolls
*Chaseburg	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Coggon	Fine-loamy, mixed, mesic Typic Hapludalfs
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
Dorerton	Loamy-skeletal, mixed, mesic Typic Hapludalfs
Dowagiac	Fine-loamy, mixed, mesic Mollic Hapludalfs
Elbaville	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Eleva	Coarse-loamy, mixed, mesic Typic Hapludalfs
Eyota	Coarse-loamy, mixed, mesic Cumulic Hapludolls
*Floyd	Fine-loamy, mixed, mesic Aquic Hapludolls
Frankville	Fine-silty, mixed, mesic Mollic Hapludalfs
Frontenac	Fine-loamy, mixed, mesic Typic Hapludolls
Garwin	Fine-silty, mixed, mesic Typic Haplaquolls
Haverhill	Fine, illitic (calcareous), mesic Typic Haplaquolls
Hoopeston	Coarse-loamy, mixed, mesic Aquic Hapludolls
Joy	Fine-silty, mixed, mesic Aquic Hapludolls
Kalmarville	Coarse-loamy, mixed, nonacid, mesic Mollic Fluvaquents
Kasson	Fine-loamy, mixed, mesic Aquollic Hapludalfs
*Kato	Fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Kegonsa	Fine-silty over sandy or sandy-skeletal, mixed, mesic Mollic Hapludalfs
Kenyon	Fine-loamy, mixed, mesic Typic Hapludolls
Lamont	Coarse-loamy, mixed, mesic Typic Hapludalfs
Lawler	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
Lilah	Sandy, mixed, mesic Psammentic Hapludalfs
Lindstrom	Fine-silty, mixed, mesic Cumulic Hapludolls
Littleton	Fine-silty, mixed, mesic Cumulic Hapludolls
Marlean	Loamy-skeletal, mixed, mesic Typic Hapludolls
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Massbach	Fine-silty, mixed, mesic Mollic Hapludalfs
Maxfield	Fine-silty, mixed, mesic Typic Haplaquolls
*Minneiska	Coarse-loamy, mixed (calcareous), mesic Mollic Udifluvents
Mt. Carroll	Fine-silty, mixed, mesic Mollic Hapludalfs
Nasset	Fine-silty, mixed, mesic Mollic Hapludalfs
Oronoco	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Ostrander	Fine-loamy, mixed, mesic Typic Hapludolls
Otter	Fine-silty, mixed, mesic Cumulic Haplaquolls
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Plainfield	Mixed, mesic Typic Udipsamments
Port Byron	Fine-silty, mixed, mesic Typic Hapludolls
Racine	Fine-loamy, mixed, mesic Mollic Hapludalfs
Radford	Fine-silty, mixed, mesic Fluvaquentic Hapludolls
Readlyn	Fine-loamy, mixed, mesic Aquic Hapludolls
Richwood	Fine-silty, mixed, mesic Typic Argiudolls
Rockton	Fine-loamy, mixed, mesic Typic Argiudolls
Root	Coarse-loamy, mixed, nonacid, mesic Mollic Fluvaquents
Salida	Sandy-skeletal, mixed, mesic Entic Hapludolls
Sawmill	Fine-silty, mixed, mesic Cumulic Haplaquolls
*Schapville	Fine, mixed, mesic Typic Argiudolls
Shullsburg	Fine, mixed, mesic Aquic Argiudolls
Skyberg	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Sogn	Loamy, mixed, mesic Lithic Haplustolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
Timula	Coarse-silty, mixed, mesic Typic Eutrochrepts
Udorthents	Loamy, mixed, mesic Udorthents
Vasa	Fine-silty, mixed, mesic Aquollic Hapludalfs
Waubeek	Fine-silty, mixed, mesyc Mollic Hapludalfs
Waucoma	Fine-loamy, mixed, mesic Mollic Hapludalfs
Waukee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
Whalan	Fine-loamy, mixed, mesic Typic Hapludalfs
Zumbro	Sandy, mixed, mesic Entic Hapludolls

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If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for

program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).