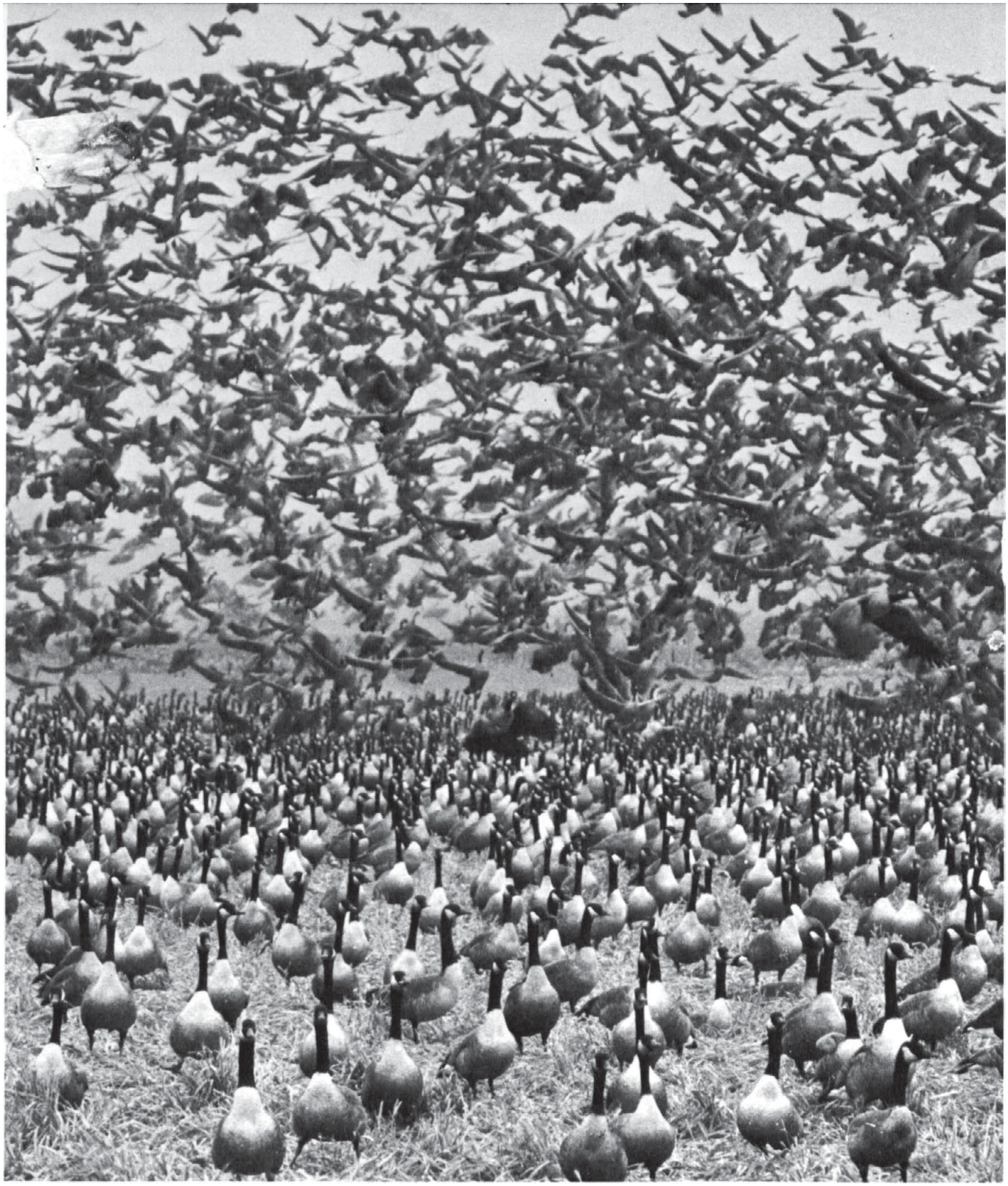

Soil Survey of

DODGE COUNTY WISCONSIN

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Research Division of the
College of Agricultural and Life Sciences
University of Wisconsin

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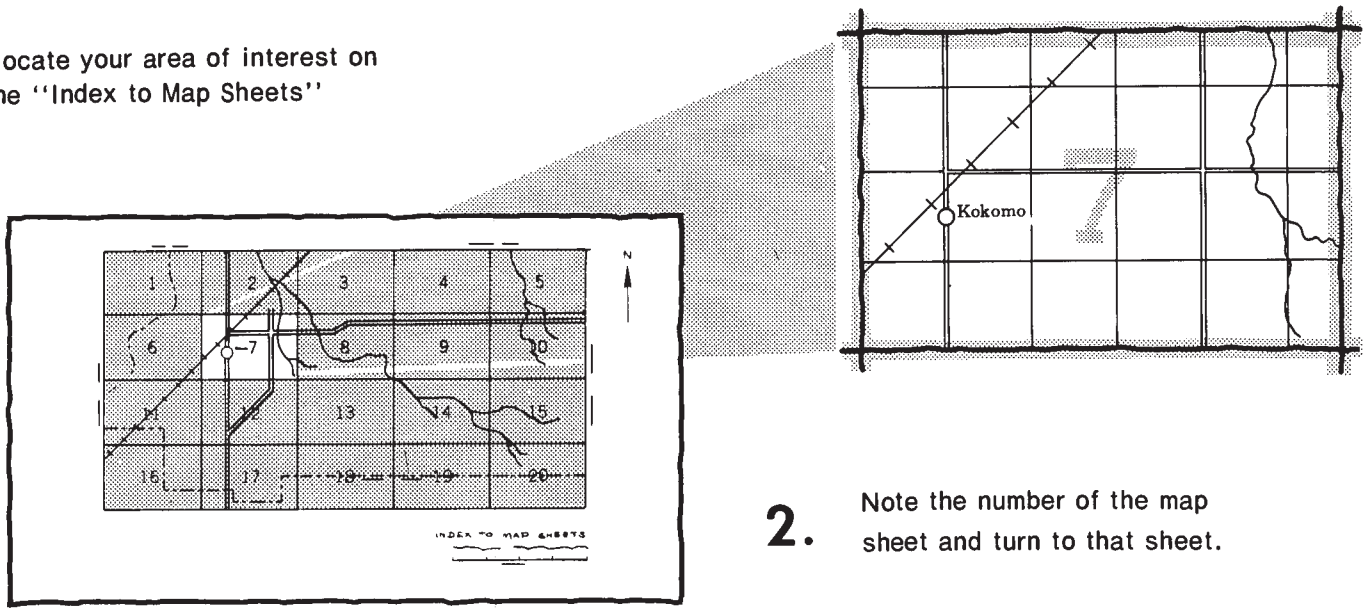

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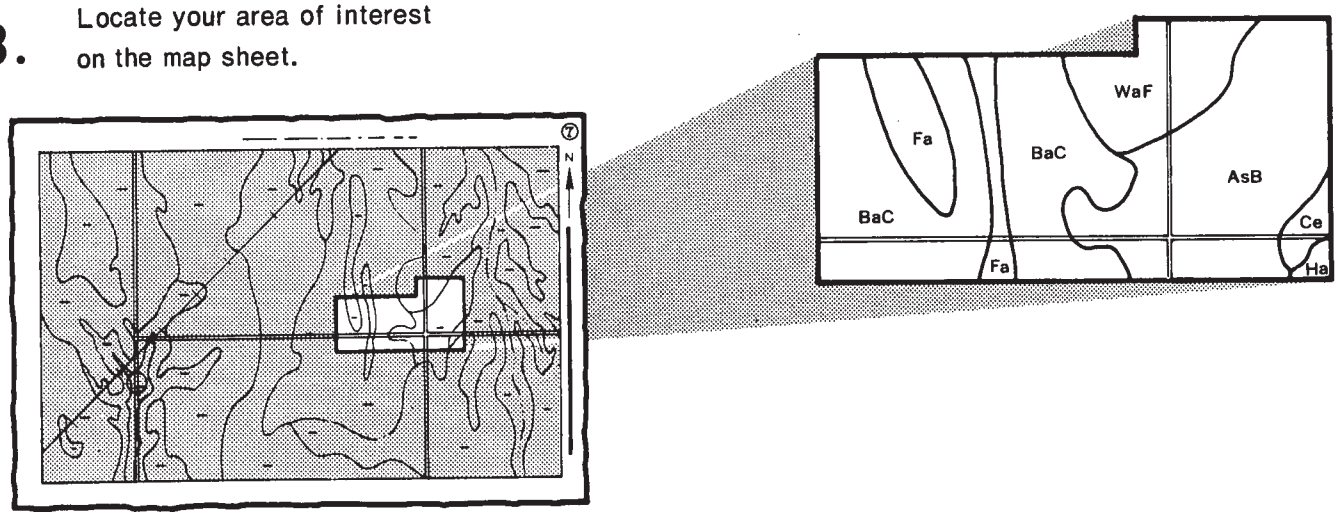

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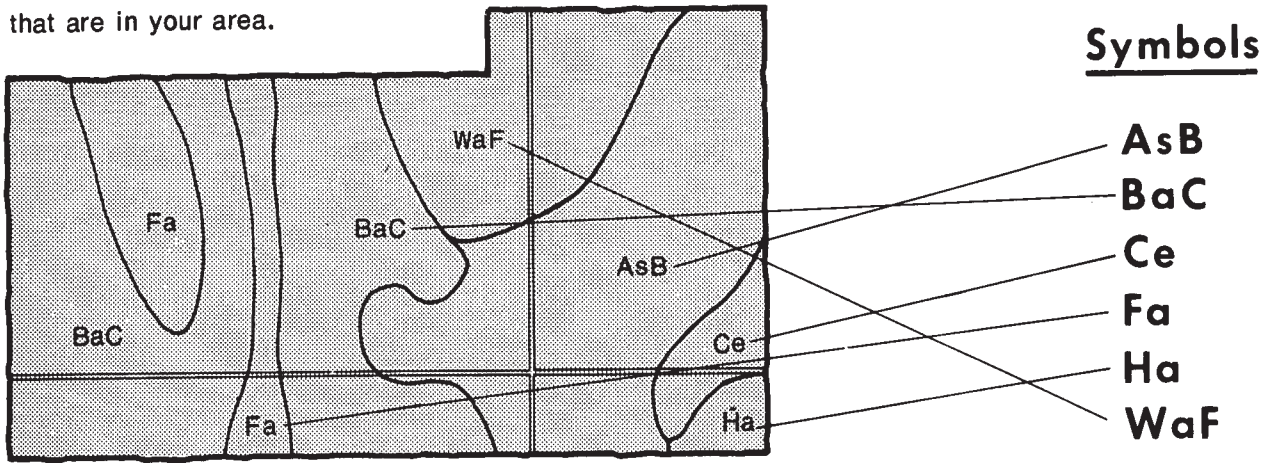

THIS SOIL SURVEY

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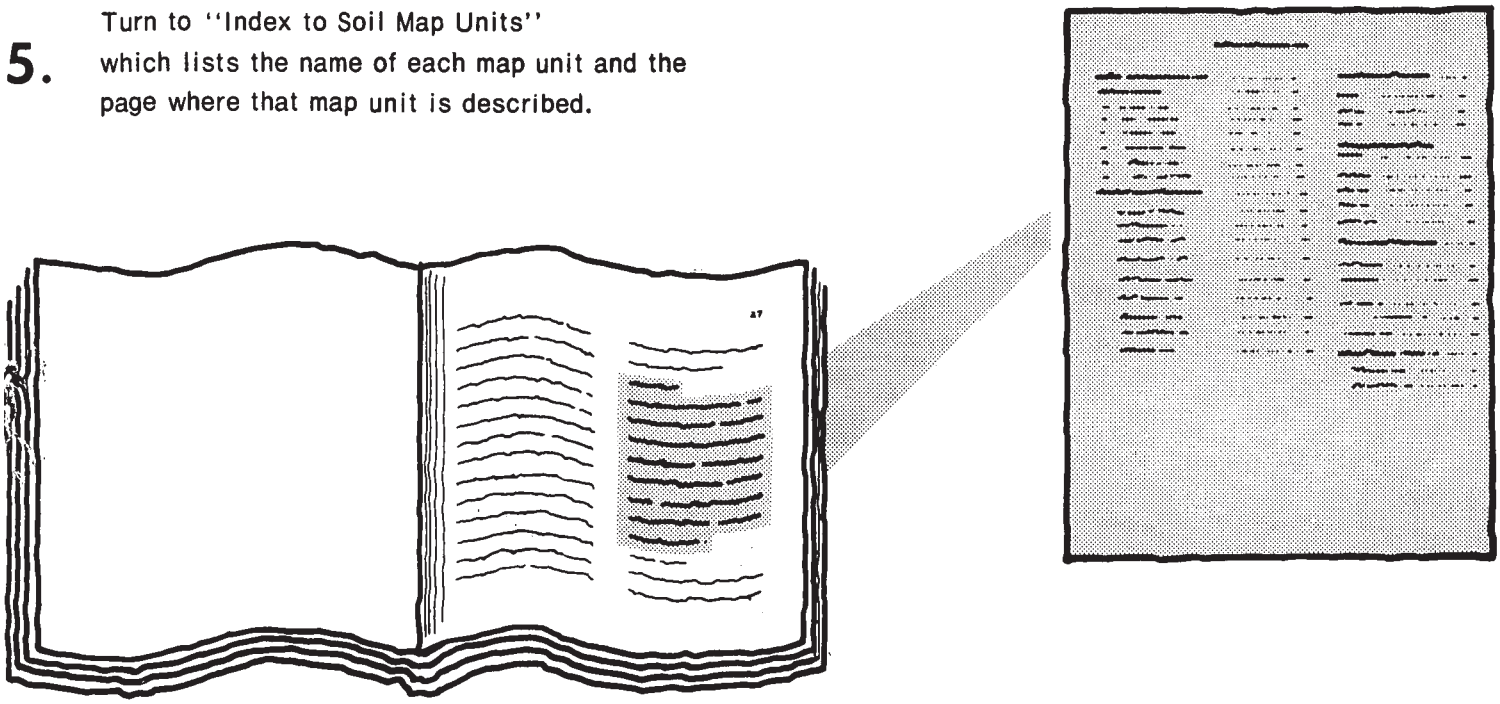
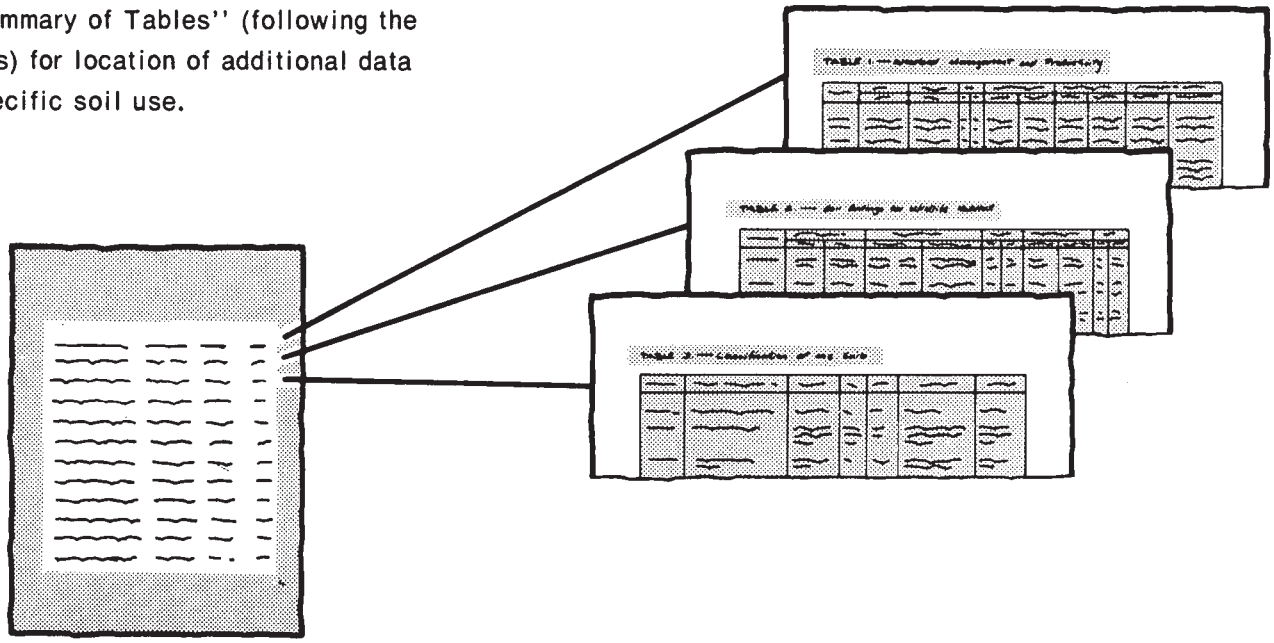


6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



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

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. 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 done in the period 1953-58. Soil names and descriptions were approved in 1967 and amended in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service and the Research Divison of the College of Agricultural and Life Sciences, University of Wisconsin. It is part of the technical assistance furnished to the Dodge County Soil and Water Conservation District, which helped to finance the fieldwork and manuscript preparation.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could 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: The Horicon National Wildlife Refuge is a resting area for migrating Canadian geese. Houghton muck is in the foreground.

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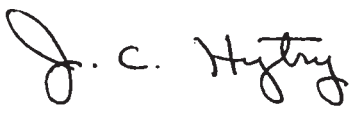
foreword

This soil survey contains much information useful in land-planning programs in Dodge County. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

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. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.



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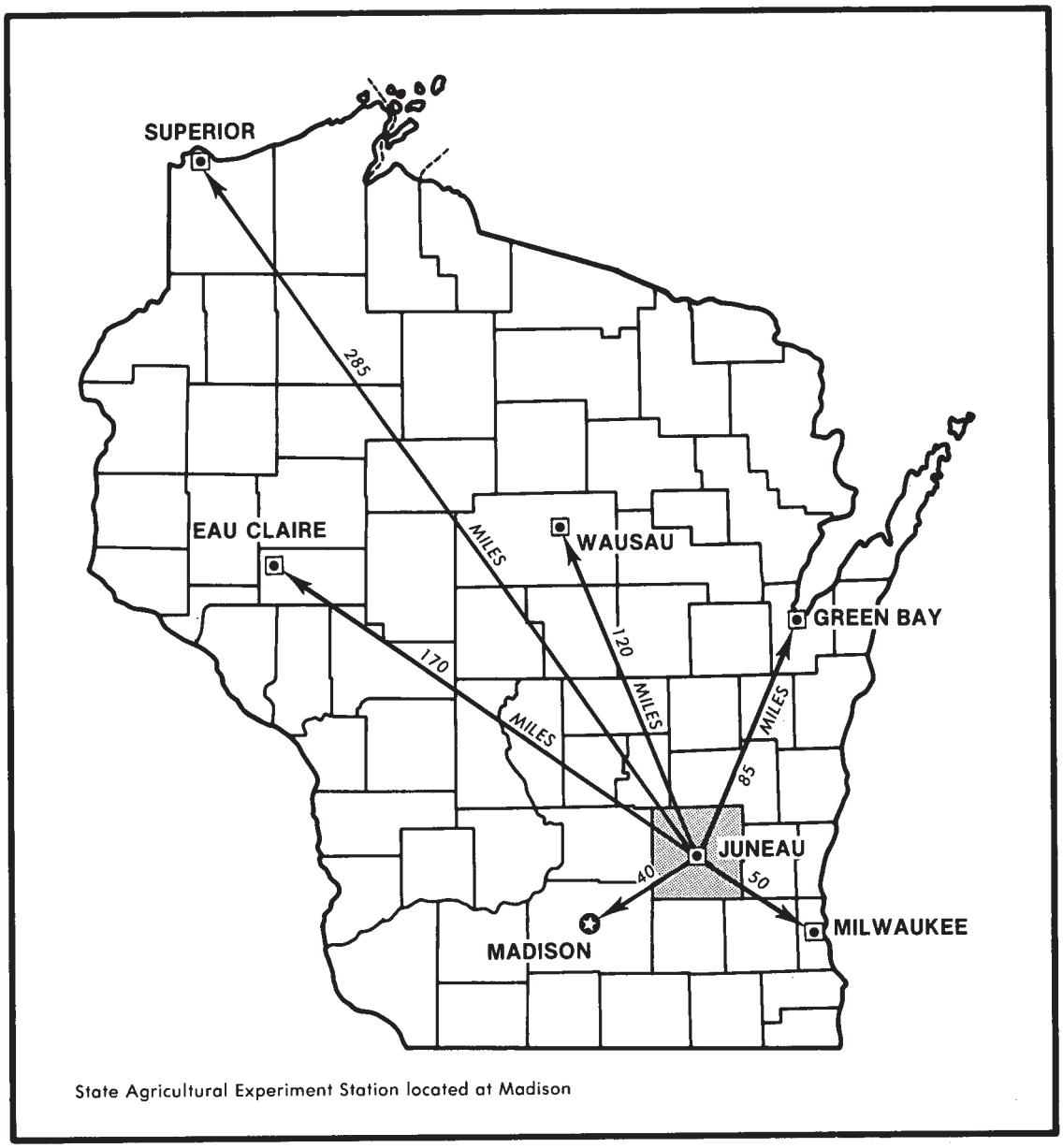

Location of Dodge County in Wisconsin.

soil survey of
Dodge County, Wisconsin

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United States Department of Agriculture, Soil Conservation Service
in cooperation with Research Division of the College of Agricultural
and Life Sciences, University of Wisconsin

DODGE COUNTY is in southeastern Wisconsin. It takes in an area of 582,400 acres, or 900 square miles, including 13,440 acres of water. The population was 69,004 in 1970. Juneau, the county seat, had a population of 2,043. Beaver Dam, the largest city, had a population of 14,265.

Dodge County is on the fringe of the region that is directly influenced by Wisconsin's two major cities—Milwaukee and Madison. Dodge County maintains a strong agricultural base; however, manufacturing employs a greater percentage of the work force. A measure of the trend toward industrialization in Dodge County is the population growth since 1950. Whereas the population of most rural counties has decreased, that of Dodge County has increased.

general nature of the county

This section gives general information about the county. It discusses climate; geology; physiography, relief, and drainage; ground water; history and development; and transportation, agriculture, and industry.

climate

The climate of Dodge County is continental, characterized by marked changes in weather common to the latitude and to interior large land masses. There is a tendency for extremes in all of the climatic elements. Spring is often late and is a mixture of warm and cold periods. In spring, the frequency of precipitation decreases and the intensity increases. Summers are warm; several hot and humid spells last for only a few days. Cool periods generally occur in summer. Dew is common in the morning and is often heavy. Fall arrives abruptly in mid-September and often lingers on into November. Nearly every year, after the killing freeze, there are abnormally warm days with clear skies or sunny but hazy days; nights are cool. The change from fall to winter is often abrupt.

Dodge County is on the northern edge of the Corn Belt. It is mainly an area of dairy farms with a considerable acreage in peas and sweet corn. Most of the crops grown, except field corn, are cool-weather crops.

The date of the last freeze in spring is usually May 12, and that of the first in fall is October 1. The length of the

growing season, the number of days between the last freeze in spring and the first in fall, averages 142 days; it varies slightly, according to nearness to water and elevation.

Precipitation normally is adequate for agriculture, but some soil moisture deficiency usually occurs in July and August. Severe drought, affecting all crops, is rare. Most summer precipitation occurs as showers that vary in duration and intensity. Three or more days of precipitation in a row can affect hay curing in fields. The probability of a dry day, less than 0.10 inch of rain, followed by at least 2 dry days is 50 percent in June and 60 percent in July and August.

Hail falls on an average of 2 days a year, generally in May. Nevertheless, hail stones that are large enough to damage crops and property may fall in the period from mid-May to mid-August.

Table 1 gives data on temperature and precipitation for Dodge County. The data were recorded at Burnett in the period 1930 to 1959. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring.

In winter, the average temperature is 20.6 degrees F, and the average daily minimum is 12.1 degrees F. The lowest temperature on record, -43 degrees F, occurred at Burnett in January 195l. In summer, the average temperature is 69 degrees F, and the average daily maximum is 81 degrees F.

As shown in table 1, the total annual precipitation is about 31 inches. Of this total, 20 inches, or 64 percent, usually falls in April through September, which includes the growing season for most crops. In about 1 year in 10, the rainfall is less than 11 inches during this period. The heaviest 1-day rainfall during the period of record was 6 inches, at Burnett, on June 21, 1940. Thunderstorms occur on an average of 40 days each year, mostly in June and July.

The average seasonal snowfall is 34 inches. The maximum monthly snowfall during the period of record was 24 inches. The first snowfall of 1 inch or more occurs around November 20; it occurs by October 25 in 1 year in 10 and by December 15 in 9 years in 10.

The percentage of possible sunshine is 60 in summer and 40 in winter. The prevailing winds are from the west in winter and the south in summer. The average windspeed is highest, 12 miles per hour, in March, April, and November.

geology

Robert F. Wilke, geologist, Soil Conservation Service, helped prepare this section.

Bedrock in Dodge County is covered mostly by loess, glacial drift, alluvium, residuum, and lacustrine deposits. Bedrock is exposed along the Niagara Escarpment and in isolated spots throughout the county.

The oldest exposed bedrock in the county is the Precambrian Waterloo quartzite (fig. 1) in several small, low domes in the southwestern part of the county. Quartzite is quarried at several locations in this area.

Ordovician and Silurian sedimentary rocks, which are underlain by Cambrian and undifferentiated Precambrian rocks, make up the bedrock in the rest of the county. The oldest known bedrock beneath glacial drift is the Ordovician Prairie du Chien Group, which is mostly dolomite. A fairly narrow band of this Prairie du Chien rock is along the western boundary of the county. Bordering the eastern edge of this band is an irregular narrow band of St. Peter sandstone, which overlies Prairie du Chien rock. Four Ordovician formations—the Platteville and Decorah formations, the Galena dolomite, and the Maquoketa shale—are in narrow north-south bands to the east of the St. Peter sandstone.

Silurian Niagara dolomite is the youngest bedrock in the county. It is in the northeast and east-central parts of the county and has outliers in the southeastern part of the county.

The north-south banded pattern of the bedrock is the result of erosion on a relatively uniform, gentle dip slope of about one degree to the east.

The unconsolidated material overlying the bedrock is predominantly glacial drift. The drift consists almost entirely of deposits of the Cary substage of the Wisconsinan Glaciation. The major glacial landforms are the till plains in the northern part of the county, a very pronounced radiating drumlin field in the southern and central parts of the county, and the Green Lake recessional moraine, which is a narrow band of low ridges that run from the east-central part of the county to the northwest corner. Glaciolacustrine deposits occur throughout the county in topographic lows. Horicon Marsh was a glacial lake that formed behind the Green Lake moraine, which acted as a dam for the glacial melt water. Small areas of the Waupun recessional moraine are in the north-central part of the county.

Recent deposits include alluvium in some of the larger valleys, eolian deposits, and organic material that is associated with glaciolacustrine deposits.

physiography, relief, and drainage

Dodge County's topography reflects both the underlying bedrock, which is mainly dolomite, and glacial action. Drumlins are very common (fig. 2), especially north of Watertown. The county has several sizable lakes as well as peat bogs and morainic hills.

Dodge County is within the Eastern Ridges and Lowlands geomorphic subsection of Wisconsin (*6*). Before glaciation, this region was probably rolling to hilly and steep with pronounced differences in elevation between ridge tops and valley bottoms, such as is typical of southwestern Wisconsin today. During glaciation, the

Figure 1.—An outcrop of Precambrian Waterloo quartzite near Portland. The soil in the foreground is Colwood silty clay loam.

topography was smoothed as the glaciers eroded the hilltops and deposited material in the valleys. The present elevation ranges from 820 feet to about 1,200 feet above sea level.

The topography of the survey area is mainly nearly level and gently sloping, but there are hilly or steep areas throughout, especially along the Niagara Escarpment (fig. 3) and its outliers in the eastern part of the survey area. Nearly level areas include parts of the shallow ground moraine overlying nearly horizontally bedded dolomite bedrock in the northern part of the county and glacial lake or terrace deposits in other parts. Some ground moraines are hilly, as are the drumlin fields in the southern, western, and eastern parts of the county. In the extreme southeastern part of Dodge County, hilly deposits of gravelly drift are associated with nearly level stream terraces near the "Kettle Moraine" area.

The average annual precipitation as recorded at Burnett is 30.98 inches. The average annual amount of runoff is 7 inches for the county. The discharge rates of rivers in Dodge County are among the lowest in the

Figure 2.—The soils in this typical drumlin area are Hochheim silt loam, 12 to 18 percent slopes, eroded, and 6 to 12 percent slopes, eroded.

state, probably because the muck soils and mineral soils hold a lot of water.

About 99 percent of Dodge County drains into the Rock-Fox River Basin. The rest, the northwest and northeast corners of the county, drains into the Fox-Wolf River Basin and the Lake Michigan Basin. The northern headwaters of the Rock-Fox River Basin are in Dodge County.

Most of the central and eastern parts of Dodge County are drained by the Rock River; the western part is drained by the Crawfish River and Beaver Dam River systems. The extreme northwest corner drains toward the Fox River. Streams in the western and central parts of the county have a lower gradient than some in the eastern part. Areas of muck or wet mineral soils are common in the county. The Horicon marsh was once a large, shallow glacial lake occupying about 51 square miles, mainly in Dodge County. It has become partly filled with muck.

Surface and ground water are adequate for domestic and livestock use. Rivers and small lakes provide domestic water as well as water for recreation uses. Lakes in Dodge County cover about 11,000 acres, and streams cover about 1,700 acres. In addition, about 6,000 acres of the Horicon marsh is flooded.

ground water

Bedrock furnishes most of the ground water for southeastern Wisconsin (*4*). Precambrian bedrock, the oldest in the basin, is overlain by layered sedimentary rocks, mostly sandstone and dolomite, of marine origin.

Precambrian crystalline bedrock is the oldest and generally the deepest in the county. The Precambrian crystalline rocks are not generally classified as aquifers, but a few wells obtain small quantities of water from small fractures in the bedrock.

A sandstone aquifer, which overlies the crystalline bedrock, is the most important aquifer in Dodge County. It underlies about 95 percent of the county and consists of several geologic formations. Properly constructed wells in the sandstone aquifer can yield 1,000 or more gallons of water per minute.

The Platteville-Galena dolomite aquifer underlies two-thirds of Dodge County. It is widely used for domestic and farm supplies where it is covered only by a thin layer of glacial drift, but it yields little water to wells where it is deeply buried, particularly where it underlies Maquoketa shale. Properly constructed wells yield from 10 to 100 gallons of water per minute.

Figure 3.—The Niagara Escarpment is a prominent physiographic feature in the eastern part of Dodge County. The soil in the foreground is Pella silty clay loam.

The Niagara dolomite aquifer in the northeastern part of the county is an important source of domestic water. Wells in this aquifer produce at least 10 gallons per minute.

Glacial drift aquifers overlie much of the bedrock throughout the county. These aquifers are the primary source of water for shallow wells and recharge to streams, springs, and lakes. The character and thickness of the drift determines the recharge, storage, and discharge of ground water. The thickness of the drift varies; it is just over 200 feet in the southeastern part of the county and less than 50 feet in the northern part. The drift is thickest beneath recessional moraines and where it fills valleys in the bedrock surface.

The availability of water from glacial deposits varies widely within small areas. The best glacial drift aquifers are thick sand and gravel outwash deposits. These sand and gravel deposits are either at or near the surface or are buried beneath less permeable deposits. Buried sand and gravel deposits occur throughout the county, but their extent is not known. Several thousand gallons of water per minute have been obtained from wells drilled in outwash sand and gravel where the aquifer is thick and underlies a perennial stream, such as along the Rock River. Small yields have been developed where the deposits are thin or small in area.

history and development

The first recorded settlement in what is now Dodge County was established by Jacob Brower in 1838 on the north side of Fox Lake. In 1840, a county government was organized, and the town of Fox Lake was designated as the first county seat. The county seat was later moved to Juneau, a more central location. Most of the principal cities and villages were established prior to 1850.

Agricultural emphasis has shifted from wheat to dairying and corn.

transportation, agriculture, and industry

The county is served by the Soo, Milwaukee, and Chicago and Northwestern railroads. Highways connect it with the Fox River Valley industrial district to the north and the Milwaukee area to the east. Scheduled flight service is available at Madison and Milwaukee.

Throughout Wisconsin, the number of farms and the acreage farmed are declining. The decline in Dodge County is slower than in most counties. From 1959 to 1969 the number of farms decreased from 3,641 to 2,461. The acreage farmed fell from 501,945 to 445,807 acres. At the same time the average size of farms increased.

Dairy cows are the most prominent kind of livestock, and dairy products are by far the most important source of farm income. Hogs, sheep, and poultry are also raised as a source of income. The county has long been important for vegetable production; it generally leads Wisconsin counties in acreage planted to sweet corn and to green peas. Most of the cultivated land is used for corn; the better soils yield as much as 145 bushels per acre. Oats and hay and some wheat are also cultivated.

At present much farmland is being converted to residential areas for nonfarm workers. Between 1963 and 1967 the county's industrial growth rate was faster than that of the State, as measured by the total value of products and by the total payroll. Food production is carried on by more than 50 firms, but the predominant production in terms of employment and value is in metalworking industries. Farm machinery manufacturing is the largest employer. Footwear manufacturing and food processing are the other leading industries.

By Wisconsin standards, very little of the land is woodland: 8 percent, compared with the State average of 43 percent. The main species are oak, elm, maple, and other hardwoods (*11*). Lime, sand and gravel, and limestone (metallurgical and roadstone) are the principal extracted minerals.

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 classifying and naming the soils, 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 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 units" and "Detailed soil map units."

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 units

The general soil map at the back of this publication shows the soil map, units or associations in the survey area. Each association is a unique natural landscape—a distinct pattern of soils, relief, and drainage. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map 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.

Most of the fieldwork in Dodge County was done prior to 1956. Since that time, many soil series in the survey area have been redefined according to guidelines in the new comprehensive soil classification system; therefore, soils now classified in the same series may have different series names on the general soil maps of older published surveys of adjacent counties. In addition, the acreage of a particular soil may differ in adjacent counties. The associations delineated in all these survey areas are, however, generally comparable in terms of parent material and drainage classes.

soil associations

1. Plano-Mendota association

Deep, nearly level to sloping, well drained and moderately well drained soils that have a silty and loamy subsoil; formed in loess and glacial till

This association is on ground moraines and drumlins that are characterized by long, even slopes.

This association makes up about 10 percent of the county. It is about 65 percent Plano soils, 15 percent Mendota soils, and 20 percent soils of minor extent.

Plano soils are nearly level and gently sloping. They are well drained and moderately well drained. Permeability is moderate. The available water capacity is high. Typically, the surface layer is very dark gray silt loam about 12 inches thick. The subsurface layer is dark brown silt loam about 6 inches thick. The subsoil extends below a depth of 60 inches. The upper part of the subsoil is brown, friable silt loam; the middle part is brown and dark brown, firm silty clay loam; and the lower part is brown, friable silt loam and dark brown, friable loam.

Mendota soils are gently sloping and sloping. They are well drained. Permeability is moderate. The available water capacity is high. Typically, the upper part of the surface layer is very dark brown silt loam about 8 inches thick, and the lower part is dark brown silt loam about 2 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam; the middle part is dark brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown and yellowish brown gravelly loam.

The minor soils in this association are the very poorly drained Houghton soils, the poorly drained Pella soils, the well drained and moderately well drained St. Charles soils, and the well drained Lomira soils. Houghton soils are in depressions on glacial lake plains and moraines. Pella soils are in depressions between drumlins and on glacial lake plains. St. Charles soils are on ground moraines and foot slopes, on side slopes, and on crests of drumlins. Lomira soils are on ground moraines.

The soils in this association have good potential for all of the cultivated crops commonly grown in the county. Most of the acreage is used for such cultivated crops as corn, small grains, and legumes; some is used for sweet corn and peas. A large acreage is used for dairy farming. Undrained wet areas are used as pasture or wildlife habitat.

In cultivated areas, the main concerns of management are controlling erosion and maintaining good soil tilth. Houghton and Pella soils need to be drained if they are to be used for crop production.

The major soils that have slopes of less than 6 percent have mainly good potential for sanitary facilities and fair potential for building site development.

2. Houghton-Pella association

Deep, nearly level, very poorly drained and poorly drained organic soils and soils that have a silty subsoil;

formed in decomposed sedges and reeds or in silty material and glacial drift

This association is in broad depressions on glacial lake plains, on moraines, and between drumlins.

This association makes up about 10 percent of the county. It is about 50 percent Houghton soils, 20 percent Pella soils, and 30 percent soils of minor extent.

Houghton soils are nearly level. They are very poorly drained. Permeability is moderately rapid. The available water capacity is very high. Typically, the organic layers are black, dark reddish brown, and dark grayish brown muck to a depth of 60 inches or more.

Pella soils are nearly level. They are poorly drained. Permeability is moderate. The available water capacity is high. Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is very dark gray silty clay loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part of the subsoil is olive gray, firm silty clay loam; the lower part is grayish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown gravelly loam.

The minor soils in this association are the very poorly drained Adrian Variant and Palms soils and the very poorly drained and poorly drained Fluvaquents. Adrian Variant and Palms soils are in depressions on glacial lake plains, till plains, and moraines. Fluvaquents are on flood plains.

Houghton soils have good potential for corn, carrots, and mint and other vegetable and specialty crops. Some of the acreage has been drained and is used for these crops. Some drained areas are in improved pasture or hay. Undrained areas are covered by a thin layer of water during wet seasons and are used as pasture or wildlife habitat. In some areas, marsh hay is harvested.

Pella soils have good potential for corn, oats, and hay. Some of the acreage has been drained and is farmed. Undrained areas are used as unimproved pasture or wildlife habitat.

In cultivated areas, the main management concern is drainage. If drained, Houghton soils are subject to subsidence, blowing, and burning. Controlled drainage is necessary to reduce subsidence and blowing in spring and fall. In addition to drainage, Pella soils need management to maintain good soil tilth.

The major soils have poor potential for sanitary facilities and building site development.

3. St. Charles-LeRoy-Lomira association

Deep, nearly level to steep, well drained and moderately well drained soils that have a silty and loamy subsoil; formed in loess and glacial till

This association is on ground moraines and drumlins that are characterized by medium and long, even slopes.

This association makes up about 11 percent of the county. It is about 35 percent St. Charles soils, 30 percent LeRoy soils, 20 percent Lomira soils, and 15 percent soils of minor extent.

St. Charles soils are nearly level to sloping. They are well drained and moderately well drained. Permeability is moderate. The available water capacity is high. Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil extends below a depth of 60 inches. The upper part of the subsoil is brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, friable loam.

LeRoy soils are gently sloping to steep. They are well drained. Permeability is moderate. The available water capacity is high. Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 13 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown gravelly loam.

Lomira soils are gently sloping and sloping. They are well drained. Permeability is moderate. The available water capacity is high. Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark brown, firm silty clay loam; and the lower part is dark brown and brown, friable sandy clay loam and loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly loam.

The minor soils in this association are the very poorly drained Houghton and Palms soils, the somewhat poorly drained Elburn soils, and the well drained Fox, Markesan, and Mendota soils. Houghton and Palms soils are in depressions on lake plains, till plains, and moraines. Elburn soils are on the lower slopes of drumlins. Fox soils are on outwash plains and terraces. Markesan and Mendota soils are on moraines and drumlins.

The soils in this association have good or fair potential for all of the cultivated crops commonly grown in the county. Most of the acreage is used for such cultivated crops as corn, small grains, and legumes; and some is used for sweet corn and peas. A large acreage is used for dairy farming. Some steeper areas are used as woodland. Undrained wet areas are used as pasture or wildlife habitat.

In cultivated areas, the main concerns of management are controlling erosion and maintaining good soil tilth. Houghton and Palms soils need to be drained if they are to be used for crop production. Elburn soils also need drainage for dependable crop production.

The major soils that have slopes of less than 6 percent have mainly good potential for sanitary facilities and fair potential for building site development.

4. Theresa-Lamartine-Hochheim association

Deep, nearly level to steep, well drained and somewhat poorly drained soils that have a silty and loamy subsoil; formed in loess and glacial till

This association is on ground moraines, drumlins, and foot slopes of drumlins that are characterized by even slopes of medium length (fig. 4).

This association makes up about 24 percent of the county. It is about 25 percent Theresa soils, 10 percent Lamartine soils, 9 percent Hochheim soils, and 56 percent soils of minor extent.

Theresa soils are gently sloping to steep. They are well drained. Permeability is moderate or moderately slow. The available water capacity is high. Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 28 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is brown, firm clay loam and loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam.

Lamartine soils are nearly level and gently sloping. They are somewhat poorly drained. Permeability is moderate. The available water capacity is high. Typically, the upper part of the surface layer is very dark grayish brown silt loam about 8 inches thick, and the lower part is grayish brown silt loam about 3 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is dark brown, mottled, friable silt loam; the middle part is dark yellowish brown, mottled, firm silty clay loam; and the lower part is brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled loam.

Hochheim soils are gently sloping to steep. They are well drained. Permeability is moderate or moderately

Figure 4.—Typical landscape in an area of the Theresa-Lamartine-Hochheim association.

slow. The available water capacity is moderate. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is brown and dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown and pale brown gravelly loam.

The minor soils in this association are the poorly drained Pella soils, the moderately well drained Mayville soils, and the well drained Dodge, Knowles, LeRoy, McHenry, and Miami soils. Pella soils are in depressions between drumlins and on glacial lake plains. Mayville soils are on foot slopes, ground moraines, and drumlins. Dodge, LeRoy, and McHenry soils are on ground moraines and drumlins. Knowles soils are on ground moraines where dolomite is at a depth of 20 to 40 inches.

Most of the soils in this association have good or fair potential for all of the cultivated crops commonly grown in the county. Moderately steep and steep Hochheim soils have poor potential for row crops. Most of the acreage of this map unit is used for such cultivated crops as corn, small grains, and legumes. A large acreage is used for dairy farming. Some steeper areas are used as woodland. Undrained wet areas are used as pasture or wildlife habitat.

In cultivated areas, the main concerns of management for Theresa and Hochheim soils are controlling erosion and maintaining good soil tilth. Lamartine soils need drainage for dependable crop production. They also need practices that maintain good soil tilth.

Theresa and Hochheim soils that have slopes of less than 6 percent have mainly good potential for sanitary facilities and building site development. Lamartine soils have poor potential for these uses.

5. Fox-Casco-Rodman association

Deep, nearly level to steep, well drained and excessively drained soils that have a silty and loamy subsoil; formed in loamy material underlain by glacial outwash

This association is on broad outwash plains and terraces, on kames, eskers, and moraines, and on pitted outwash plains that are characterized by short, uneven slopes, depressions, and closed drainageways.

This association makes up about 2 percent of the county. It is about 60 percent Fox soils, 20 percent Casco soils, 10 percent Rodman soils, and 10 percent soils of minor extent.

Fox soils are nearly level to steep. They are well drained. Permeability is moderate in the surface layer and subsoil and very rapid in the substratum. The available water capacity is moderate. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, firm silty clay loam; and the lower part is dark yellowish brown, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown sand and gravel.

Casco soils are gently sloping to steep. They are well drained. Permeability is moderate in the surface layer and subsoil and very rapid in the substratum. The available water capacity is moderate. Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick, and the lower part is brown loam about 3 inches thick. The subsoil is dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown sand and gravel.

Rodman soils are sloping to steep. They are excessively drained. Permeability is very rapid. The available water capacity is very low. Typically, the surface layer is very dark gray gravelly loam about 5 inches thick. The subsoil is dark yellowish brown, friable gravelly loam about 6 inches thick. The substratum, to a depth of about 60 inches, is pale brown sand and gravel.

The minor soils in this association are the well drained McHenry and Theresa soils. McHenry soils are on ground moraines and drumlins. Theresa soils are on ground moraines, drumlins, and moraines.

Casco and Fox soils that have slopes of less than 12 percent have mainly fair potential for all of the cultivated crops commonly grown in the county. Moderately steep and steep Casco and Fox soils have poor potential for cultivated crops. Most of the acreage of Casco and Fox soils is used for such cultivated crops as corn, small grains, and legumes. A large acreage is used for dairy farming. Rodman soils and some of the steeper areas of Casco and Fox soils are used as woodland.

In cultivated areas, the main concerns of management are controlling erosion and maintaining good soil tilth.

The major soils that have slopes of less than 6 percent have mainly poor potential for sanitary facilities and good or fair potential for building site development. The substratum of these soils is a good source of sand and gravel.

6. St. Charles-Miami-Elburn association

Deep, nearly level to steep, well drained to somewhat poorly drained soils that have a silty and loamy subsoil; formed in loess and glacial till

This association is on moraines and drumlins that are characterized by long, even slopes.

This association makes up about 36 percent of the county. It is about 25 percent St. Charles soils, 24 percent Miami soils, 18 percent Elburn soils, and 33 percent soils of minor extent.

St. Charles soils are nearly level to sloping. They are well drained and moderately well drained. Permeability is moderate. The available water capacity is high. Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil extends below a depth of 60 inches. The upper part of the subsoil is brown and dark brown, firm silty clay loam; the lower part is dark brown and dark yellowish brown, friable loam.

Miami soils are gently sloping to steep. They are well drained. Permeability is moderate or moderately slow. The available water capacity is high. Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part of the subsoil is brown, firm clay loam; the middle part is brown, firm sandy clay loam; and the lower part is dark yellowish brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam.

Elburn soils are nearly level and gently sloping. They are somewhat poorly drained. Permeability is moderate. The available water capacity is high. Typically, the surface layer is black silt loam about 18 inches thick. The subsoil is about 30 inches thick. The upper part of the subsoil is dark grayish brown, friable silt loam; the middle part is dark brown, firm silty clay loam and brown, friable silt loam; and the lower part is dark brown, firm sandy loam. The substratum, to a depth of about 60 inches, is yellowish brown sandy loam.

The minor soils in this association are the poorly drained Ackmore and Pella soils, the somewhat poorly drained Lamartine soils, the moderately well drained Neda soils, and the well drained Dodge, Kidder, LeRoy, and Sisson soils. Ackmore soils are on flood plains and alluvial fans. Pella soils are on glacial lake plains and in depressions between drumlins. Lamartine soils are on foot slopes of ground moraines and drumlins and on the crest of wide drumlins. Neda soils are on foot slopes of ground moraines, on drumlins, and on terraces. Dodge, Kidder, and LeRoy soils are on moraines and drumlins. Sisson soils are on glacial lake plains and ground moraines.

Most of the soils in this association have good potential for all of the cultivated crops commonly grown in the county. Moderately steep and steep Miami soils have poor potential for row crops. Most of the acreage is used for such cultivated crops as corn, small grains, and legumes. A large acreage is used for dairy farming. Undrained wet areas are used as pasture or wildlife habitat.

In cultivated areas, the main concerns of management for St. Charles and Miami soils are controlling erosion and maintaining good soil tilth. Elburn soils need drainage for dependable crop production. They also need practices that maintain good soil tilth.

St. Charles and Miami soils that have slopes of less than 6 percent have mainly good potential for sanitary facilities and building site development. Elburn soils have poor potential for these uses.

7. McHenry-Pella association

Deep, nearly level to moderately steep, well drained and poorly drained soils that have a silty and loamy subsoil; formed in loess and glacial till or glacial drift

This association is on ground moraines and drumlins that are characterized by medium and long, even slopes and in broad depressions on glacial lake plains and moraines and between drumlins (fig. 5).

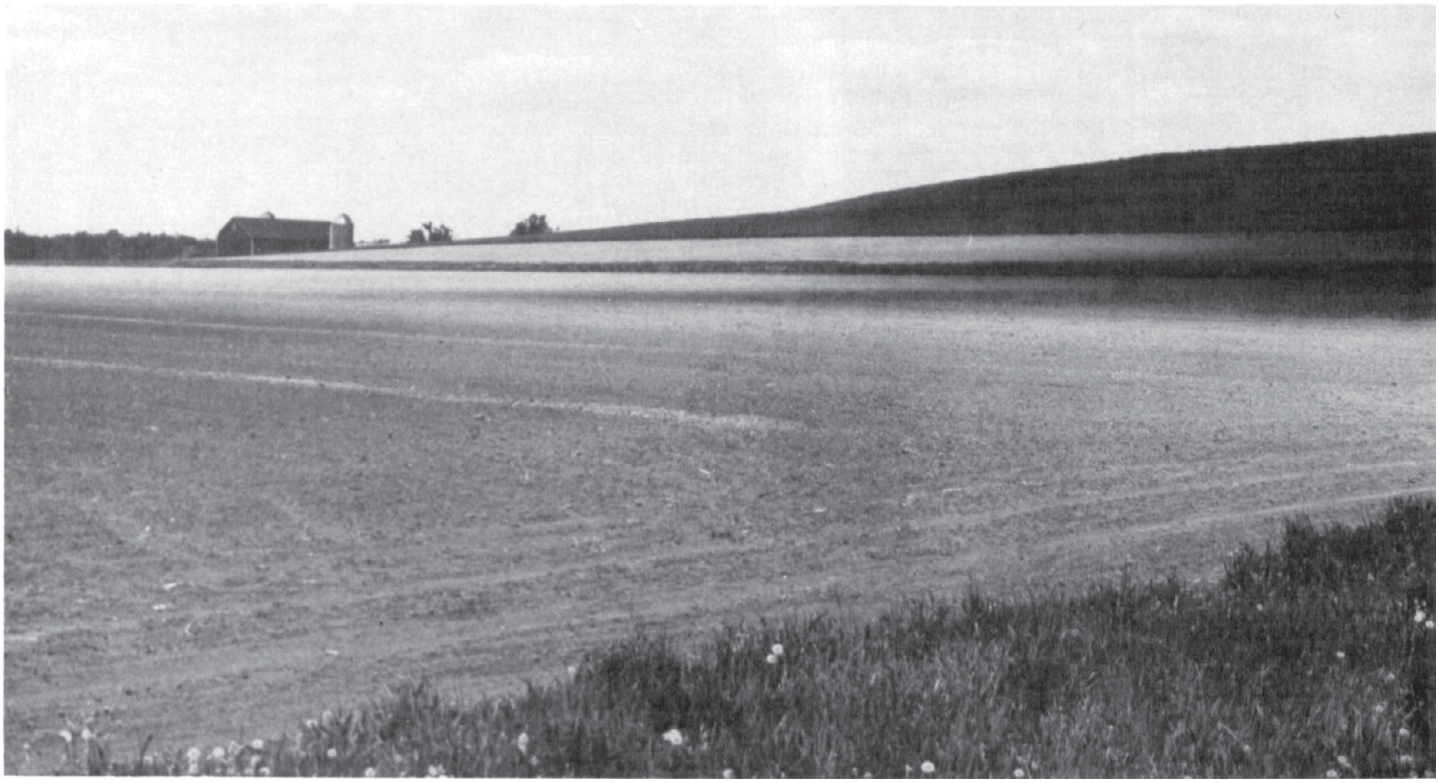

Figure 5.—Typical landscape in an area of the McHenry-Pella association.

This association makes up about 7 percent of the county. It is about 35 percent McHenry soils, 30 percent Pella soils, and 35 percent soils of minor extent.

McHenry soils are gently sloping to moderately steep. They are well drained. Permeability is moderate. The available water capacity is high. Typically, the upper part of the surface layer is dark grayish brown silt loam about 6 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 26 inches thick. The upper part of the subsoil is brown, firm silty clay loam; the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown gravelly sandy loam.

Pella soils are nearly level. They are poorly drained. Permeability is moderate. The available water capacity is high. Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is very dark gray silty clay loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part of the subsoil is olive gray, firm silty clay loam; the lower part is grayish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown gravelly loam.

The minor soils in this association are the somewhat poorly drained Elburn soils and the well drained Miami soils. Elburn soils are on ground moraines and on the foot slopes of drumlins. Miami soils are on moraines and drumlins.

McHenry soils have good or fair potential for all of the cultivated crops commonly grown in the county. Most of the acreage is used for such cultivated crops as corn, small grains, and legumes. A large acreage is used for dairy farming. Some of the steeper McHenry soils are used as woodland.

Pella soils have good potential for corn, oats, and hay. Some of the acreage has been drained and is farmed. Undrained areas are used as unimproved pasture or wildlife habitat.

In cultivated areas, the main concerns of management for McHenry soils are controlling erosion and maintaining good soil tilth. Pella soils need drainage and practices that maintain good soil tilth.

McHenry soils that have slopes of less than 6 percent have mainly fair potential for sanitary facilities and building site development. Pella soils have poor potential for these uses.

detailed soil map units

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 that have 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 Theresa series, for example, was named for the town of Theresa in Dodge 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, Fox silt loam, 0 to 2 percent slopes, is one of several phases within the Fox series.

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

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. Rodman-Casco complex, 12 to 30 percent slopes, eroded, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Theresa soils, 12 to 25 percent slopes, severely eroded, is an undifferentiated group in this survey area.

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 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 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.

Some of the soil descriptions on the following pages contain statements about soil potentials, means of overcoming soil limitations, and suitability for waste disposal. Some of the methods described are controlled by local or state ordinances.

descriptions of the soils

AcA—Ackmore silt loam, 0 to 3 percent slopes. This is a nearly level and gently sloping, poorly drained soil in concave areas on flood plains or alluvial fans. It is subject to flooding for very brief periods. Areas of this map unit are irregular in shape and range from 5 to 70 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The layer below that is multicolored, friable silt loam about 16 inches thick. Below that there is a buried horizon of black, firm silty clay loam that is 10 inches thick. The next layer, to a depth of about 60 inches, is olive gray, firm silty clay loam.

Included in mapping are small areas of poorly drained Pella soils and areas where the colluvial deposits are underlain by loamy or sandy soils. Pella soils are in depressions and are underlain by glacial drift. The included soils make up about 5 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the upper part of the soil and high in the lower part. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted by the water table.

Most drained areas of this soil are farmed. The potential is good for row crops if the soil is drained, good for hay and pasture, and fair for trees. The potential is very poor for most engineering uses.

If drained, this soil is suited to corn and small grain. It is suited to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil wetness generally necessitates planting by hand or machine on prepared ridges if natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid mortality. Harvest is frequently limited to periods when the soil is frozen. Harvesting by clearcutting or group selection can help reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass 3w.

Ar—Adrian Variant muck. This nearly level, very poorly drained soil is in depressions on glacial lake plains. It is frequently subject to very long periods of flooding. Areas of this map unit are irregular in shape and range from 15 to 30 acres in size. Slopes are 0 to 2 percent.

Typically, the organic layers are black and very dark brown muck about 16 inches thick. Below this is very dark gray sedimentary peat about 8 inches thick. The substratum, to a depth of about 60 inches, is dark gray stratified fine sand and coarse silt. In places, the surface layer is mucky peat or peat.

Included in mapping are small areas of Houghton muck in depressions. This soil formed in organic layers that are more than 51 inches thick. It makes up about 10 percent of the map unit.

Water and air move at a slow rate through this soil. Surface runoff is very slow or ponded. The available water capacity is very high, and natural fertility is low. The shrink-swell potential is low in the substratum. The soil is saturated at the surface or to a depth of 1 foot for many months during wet seasons. The organic layers are friable and easily tilled throughout a wide range in moisture content. Root development is restricted by the water table.

Undrained areas of this soil are used mainly as wildlife habitat or for marsh hay. Drained areas are used for corn and canning crops. The potential is good for these crops and fair for trees. The potential is poor for most engineering uses.

If this soil is drained and cultivated, soil blowing and subsidence become problems. Windbreaks and cover crops reduce soil blowing, and controlled drainage reduces the rate of subsidence. The underlying sedimentary peat and the fine sand and silt substratum are unstable; as a result, ditchbanks can cave and tile drains can clog rapidly.

This soil is suited to commercial wood production. Soil wetness and the high water table during the tree planting season limit reforestation to natural regeneration. Harvesting with heavy equipment is confined to periods when the soil is frozen. Harvesting by clearcutting or area selection can reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IVw; woodland suitability subclass 3w.

AsA—Ashippun silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on ground moraines and terraces and on foot slopes of drumlins. This soil is rarely flooded. Areas of this map unit are irregular in shape and range from 5 to 25 acres in size.

Typically, the upper part of the surface layer is very dark grayish brown silt loam about 8 inches thick, and the lower part is dark grayish brown silt loam about 3

inches thick. The subsoil is about 18 inches thick. The upper part of the subsoil is olive brown, mottled, firm silty clay loam; the lower part is olive brown, mottled, firm clay loam. The substratum, to a depth of 60 inches, is grayish brown, very friable loam in the upper 4 inches and light olive brown and light yellowish brown loam in the lower 27 inches. In places, the surface layer is very dark gray; in some areas, stones and cobblestones are on the surface.

Included in mapping are small areas of poorly drained soils that formed in shaly glacial drift. These soils are in slightly lower areas on the landscape than the Ashippun soil. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff is slow in cultivated areas. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. Root development is restricted by the water table.

Most areas of this soil are used for farming. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, canning crops, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce surface crusting, and increase water infiltration.

If this soil is used as pasture or for hay, overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table and moderately slow permeability. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil is also poorly suited to building site development. If used for this purpose, the soil should be drained, and diversions should be used to protect the site from flooding. Low strength and frost action are limitations to the construction of local roads and streets. Suitable base material can help overcome these limitations.

Capability subclass IIw; woodland suitability subclass 3o.

AsB—Ashippun silt loam, 2 to 6 percent slopes. This is a gently sloping, somewhat poorly drained soil in concave areas on ground moraines and terraces and on foot slopes of drumlins. This soil is subject to rare flooding. Areas of this map unit are irregular in shape and range from 5 to 30 acres in size.

Typically, the upper part of the surface layer is very dark grayish brown silt loam about 8 inches thick, and the lower part is dark grayish brown silt loam about 3 inches thick. The subsoil is about 15 inches thick. The upper part of the subsoil is olive brown, mottled, firm silty clay loam; the lower part is olive brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is grayish brown loam in the upper 4 inches and light olive brown and light yellowish brown loam in the lower part. In places, the surface layer is very dark gray. Shale bedrock outcrops in places.

Included in mapping are small areas of Ashippun soils that have slopes of more than 6 percent, moderately well drained Neda soils, and Neda Variant soils. Neda soils, Neda Variant soils, and the Ashippun soil are in similar positions on the landscape and formed in similar material. The included soils make up about 15 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff is medium in cultivated areas. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, canning crops, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a slight hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

If this soil is used as pasture, grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Brushy vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table and moderately slow permeability. The suitability for septic tank absorption fields can be

improved by building a filtering mound. This soil is also poorly suited to building site development. If used for this purpose, the soil should be drained, and diversions should be constructed to protect the site from flooding. Low strength and frost action are limitations to the construction of roads and streets. A suitable base material can help overcome these limitations.

Capability subclass IIe; woodland suitability subclass 3o.

BsA—Brookston silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, very poorly drained soil is in depressions on ground moraines and along drainageways. It is frequently subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is black and very dark gray silt loam about 12 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is grayish brown and dark grayish brown, mottled, firm silty clay loam; the middle part is dark grayish brown, mottled, firm clay loam; and the lower part is grayish brown, mottled, friable loam. The substratum, to a depth of about 60 inches, is grayish brown sandy loam. In places, the underlying till is gravelly, and in other places, it is channery and flaggy. In some areas, the surface layer is thicker than described in the typical profile.

Included in mapping are small areas of poorly drained Pella soils. They are in depressions between drumlins and on glacial lake plains and are underlain by glacial drift. These inclusions make up about 5 percent of the map unit.

Water and air move at a moderately slow or moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate. This soil is saturated to a depth of 1 foot for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted by the water table.

Most drained areas of this soil are farmed. The potential is fair for row crops, hay, and pasture and poor for trees. The potential is poor for most engineering uses.

If drained, this soil is suited to corn, grain, hay, or pasture. If it is not drained, it is suited to permanent pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth.

This soil is poorly suited to commercial wood production. Slow growth and poor form make trees barely merchantable. Soil wetness generally necessitates planting by hand or machine on prepared ridges if natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid mortality. Harvest is frequently limited to periods when the soil is frozen. Harvesting by clearcutting or group selection can help reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass 4w.

CcB—Casco loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in convex areas on glacial outwash terraces, on crests of kames and eskers, and on moraines. Areas of this map unit are oval and range from 2 to 10 acres in size.

Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick, and the lower part is brown loam about 3 inches thick. The subsoil is dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown sand and gravel. In places, the surface layer is silt loam or fine sandy loam. In places, the soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained Fox soils and excessively drained Rodman soils. The Fox soils are thicker over sand and gravel than the Casco soil and are in similar positions on the landscape. The Rodman soils are thinner over sand and gravel than the Casco soil and are on more convex slopes. The included soils make up 10 to 15 percent of the map unit.

Water and air move at a moderate rate through the upper part of this soil and at a very rapid rate through the substratum. Surface runoff is medium in cultivated areas. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and very low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. Roots of most crops do not develop well in the droughty substratum.

About half of the acreage of this soil is used for farming; the rest is used mainly for trees. The potential is fair for cultivated row crops, hay, pasture, and trees. The potential is poor to good for engineering uses.

This soil is suited to corn and oats. It is well suited to hay, pasture, and trees. If this soil is used for cultivated crops, erosion and drought are slight hazards. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. The shallowness to sand and gravel prevents extensive use of terraces and diversions. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility.

The use of this soil as pasture or for hay is also effective in controlling erosion. Overgrazing and grazing when the soil is too wet can cause surface compaction and poor tilth. A proper stocking rate, pasture rotation,

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

This soil is suited to commercial wood production. The seedling survival rate can be increased by careful planting of vigorous nursery stock. Competing vegetation which might interfere with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to most sanitary facilities. It is well suited to use as septic tank absorption fields, but pollution of ground water is a hazard because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. In most areas this soil is well suited to building site development if proper design and installation procedures are used. Frost action is a limitation to the use of this soil as sites for local streets and roads. Adding suitable base material helps to overcome this limitation. The substratum is a good source of sand and gravel.

Capability subclass IIIe; woodland suitability subclass 3s.

CcC2—Casco loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of glacial outwash terraces, kames, and eskers. Areas of this map unit are oval or elongated and range from about 5 to 15 acres in size.

Typically, the upper part of the surface layer is dark grayish brown loam about 6 inches thick, and the lower part is brown loam about 2 inches thick. The subsoil is dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown sand and gravel. In places, the surface layer is silt loam or fine sandy loam. In some areas, the soil is not eroded.

Included in mapping are small areas of severely eroded Casco soils that have a clay loam surface layer, well drained Fox soils, and excessively drained Rodman soils. Fox soils are thicker over sand and gravel than the Casco soil and are in similar positions on the landscape. Rodman soils are thinner over sand and gravel and have more convex slopes. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the upper part of this soil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and very low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. Some subsoil material is mixed in the plow layer, so this soil is somewhat difficult to till when wet. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Roots of most crops do not develop well in the droughty substratum of this soil.

A small acreage of this soil is farmed, and many areas are woodland. The potential is fair for row crops, pasture, and trees. The potential is poor to good for most engineering uses.

This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways can help prevent excessive erosion. Returning crop residue to the soil or regularly adding organic matter helps to improve fertility.

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

This soil is suited to commercial wood production. The seedling survival rate can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to most sanitary facilities. Ground water pollution is a hazard because of the very rapid permeability of the substratum. This soil is suited to building site development if proper design and installation procedures are used. Because of steepness of slope, land shaping may be necessary unless an area of lesser slope is part of the area. Frost action is a limitation to the use of this soil as sites for local roads and streets unless a suitable base material is added. The substratum is a good source of sand and gravel.

Capability subclass IVe; woodland suitability subclass 3s.

CcD2—Casco loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is on convex side slopes of glacial outwash terraces, kames, and eskers. Areas of this map unit are long and narrow and range from 3 to 10 acres in size.

Typically, the upper part of the surface layer is dark grayish brown loam about 6 inches thick, and the lower part is brown loam about 2 inches thick. The subsoil is dark brown, firm clay loam about 8 inches thick. The substratum, to a depth of about 60 inches, is brown sand and gravel. In places, the surface layer is silt loam or fine sandy loam. In some areas the soil is not eroded.

Included with this soil in mapping are small areas of severely eroded Casco soils that have a clay loam surface layer, well drained Fox soils, and excessively drained Rodman soils. Fox soils are thicker over sand and gravel than the Casco soil and are in similar positions on the landscape. Rodman soils are thinner over sand and gravel and are on more convex slopes. The included soils make up about 25 percent of the map unit.

Water and air move at a moderate rate through the upper part of this soil and at a very rapid rate through

the substratum. Surface runoff in cultivated areas is medium or rapid. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and very low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. Some subsoil material is mixed in the plow layer, so this soil is somewhat difficult to till when wet. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Roots of most crops do not develop well in the droughty substratum of this soil.

In most areas, this soil is used for hay and as pasture and woodland. The potential is fair for hay, pasture, and trees. The potential is poor for most engineering uses.

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

This soil is suited to commercial wood production. Erosion can be controlled by planting trees on the contour and by carefully locating skid roads during harvest. Both of these practices simplify use of equipment. The rate of survival of planted trees can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is mainly poorly suited to sanitary facilities because of steepness of slope. There also is a hazard of pollution of ground water because of the very rapid permeability of the substratum. This soil is poorly suited to building site development. Because of steepness of slope, land shaping may be necessary unless there is an area of lesser slope within the larger area. The substratum is a good source of sand and gravel.

Capability subclass VIe; woodland suitability subclass 3s.

CdB—Channahon silt loam, 1 to 6 percent slopes. This nearly level to gently sloping soil is in convex areas on ground moraines that are underlain by dolomite bedrock at a depth of 10 to 20 inches. Areas of this map unit are irregular in shape and range from 5 to 25 acres in size.

Typically, the upper part of the surface layer is very dark brown silt loam about 9 inches thick, and the lower part is very dark grayish brown silt loam about 4 inches thick. The subsoil is dark brown, firm silty clay loam about 5 inches thick. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In places, the soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil. In some places, the subsoil is clay loam.

Included in mapping are small areas of well drained Knowles soils. Knowles soils and the Channahon soil are in similar positions on the landscape, and the Knowles soils are thicker over dolomite bedrock. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is low, and natural fertility is medium. The shrink-swell potential is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted below a depth of 10 to 20 inches by dolomite bedrock. In places, however, roots grow into soil-filled crevices in the dolomite.

Some areas of this soil are farmed. The potential is poor for cultivated crops and fair for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is poorly suited to corn and is fairly suited to small grains, and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Minimum tillage and winter cover crops help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keeps the soil in good condition.

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

This soil is suited to commercial wood production. The rate of survival of planted trees during dry seasons can be increased by careful planting of vigorous nursery stock. Harvesting by clearcutting or area selection can help reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the shallowness to bedrock. The suitability for septic tank absorption fields can be improved by building a filtering mound. Excavation for dwellings with basements is difficult because of bedrock.

Capability subclass IIIe; woodland suitability subclass 3d.

CdC2—Channahon silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of ground moraines that are underlain by dolomite bedrock at a depth of 10 to 20 inches. Areas of this map unit are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is dark brown, firm silty clay loam about 5 inches thick. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In some areas this soil is not eroded. In places, the subsoil is clay loam.

Included in mapping are small areas of well drained Knowles soils. Knowles soils and the Channahon soil are in similar positions on the landscape, and Knowles soils are thicker over dolomite bedrock. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is low, and natural fertility is medium. The shrink-swell potential is moderate. The surface layer is friable and easily tilled at the proper moisture content. Some subsoil material is mixed in the plow layer, so this soil is somewhat difficult to till when wet. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development is restricted below a depth of 10 to 20 inches by dolomite bedrock. In places, however, roots grow into soil-filled crevices in the dolomite.

Some areas of this soil are farmed. The potential is poor for cultivated crops and fair for pasture, hay, and trees. The potential is poor for most engineering uses.

This soil is poorly suited to corn and small grains. It is suited to grasses and legumes for hay and pasture. If this soil is cultivated, erosion is a severe hazard. Minimum tillage and winter cover crops help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and keep the soil in good condition.

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

This soil is suited to commercial wood production. The rate of survival of planted trees during dry seasons can be increased by careful planting of vigorous nursery stock. Harvest by clearcutting or area selection can help reduce windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the bedrock. Excavation for dwellings with basements is difficult also because of bedrock.

Capability subclass IVe; woodland suitability subclass 3d.

CdD2—Channahon silt loam, 12 to 25 percent slopes, eroded. This moderately steep and steep, well drained soil is on convex side slopes of ground moraines that are underlain by dolomite bedrock at a depth of 10 to 20 inches. Areas of this map unit are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is dark brown, firm silty clay loam about 5 inches thick. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In some areas this soil is not eroded. In places, the subsoil is clay loam.

Included in mapping are small areas of well drained Knowles and LeRoy soils. In places, there are outcrops of dolomite. The included soils and the Channahon soil are in similar positions on the landscape. The Knowles soils are thicker over dolomite bedrock than the Channahon soils, and the LeRoy soils are underlain by glacial till that contains dolomite fragments.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is low, and natural fertility is medium. The shrink-swell potential is moderate. The surface layer is friable and easily tilled at the proper moisture content, but when the soil is wet, tillage is somewhat difficult because some subsoil material is in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development is restricted below a depth of 10 to 20 inches by the dolomite bedrock. In places, however, roots grow into soil-filled crevices in the dolomite.

In most areas, this soil is used as pasture or woodland. The potential is fair for pasture and trees. The potential is poor for most engineering uses.

If this soil is used as pasture, overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Erosion can be controlled by planting trees on the contour and by carefully locating skid roads during harvest operations. These practices also improve equipment trafficability. The mortality rate of planted trees can be reduced by careful planting and use of vigorous nursery stock. Harvesting by clearcutting or area selection can reduce windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the shallowness to bedrock and the steepness of the slope. Land shaping to reduce slope and excavating for dwellings with basements are difficult because of the bedrock.

Capability subclass VIe; woodland suitability subclass 3d.

ChB—Chelsea loamy fine sand, 2 to 6 percent slopes. This gently sloping, excessively drained soil is in concave areas on uplands where windblown sand has been deposited over glacial drift. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish

brown and dark brown, loose fine sand about 29 inches thick. The next layer, to a depth of about 60 inches, is dark brown, loose fine sand that has 1/8- to 3/8-inch-thick layers of yellowish brown loamy fine sand. In places, the sand is less than 5 feet thick.

Included in mapping are small areas of well drained and moderately well drained Puchyan soils and well drained Sisson soils. Puchyan soils and the Chelsea soil are in similar positions on the landscape, and Puchyan soils have loamy layers. Sisson soils are on glacial lake plains and formed in loamy lacustrine material. The included soils make up about 10 percent of the map unit.

Water and air move at a rapid rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is low, and natural fertility is low. The shrink-swell potential is low. The surface layer is friable and easily tilled at all moisture conditions.

A few areas of this soil are cultivated. Some areas are wooded, and some areas that were once cropland are idle and are reverting to woodland. The potential is fair for row crops, hay, pasture, and trees. The potential is poor to good for engineering uses.

This soil is suited to corn, small grains, and grasses and legumes for hay and pasture, but yields are generally relatively low. If this soil is used for cultivated crops, soil blowing is a hazard. Minimum tillage and winter cover crops can help prevent excessive soil loss. Windbreaks at strategic locations can help prevent soil blowing. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and reduce soil blowing.

The use of this soil as pasture or for hay is also effective in controlling erosion. A proper stocking rate, pasture rotation, and timely deferment of grazing help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. The seedling survival rate can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to most sanitary facilities because of seepage. Sealing the soil material can reduce seepage. This soil is well suited to septic tank absorption fields, but ground water pollution is a hazard. This soil is well suited to building site development.

Capability subclass IVs; woodland suitability subclass 3s.

ChC—Chelsea loamy fine sand, 6 to 18 percent slopes. This sloping and moderately steep, excessively drained soil is on convex side slopes of ground moraines and drumlins where windblown sand has been deposited. Areas of this map unit are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown and dark brown, loose fine sand about 29 inches thick. Below this, to a depth of about 60 inches, is dark brown, loose fine sand that has 1/8- to 3/8-inch-thick layers of yellowish brown loamy fine sand. In places, the sand is less than 5 feet thick.

Included in mapping are small areas of well drained and moderately well drained Puchyan soils and well drained Sisson soils. Puchyan and Chelsea soils are in similar positions on the landscape, but the Puchyan soil has loamy layers. Sisson soils are on glacial lake plains and formed in loamy lacustrine material. The included soils make up about 10 percent of the map unit.

Water and air move at a rapid rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is low, and natural fertility is low. The shrink-swell potential is low. This soil is friable and easily tilled at all moisture conditions.

A few areas of this soil are cultivated. Some areas are wooded, and some areas that were once cropland are idle and are reverting to woodland. This soil is not suitable for farming. The potential is fair for hay, pasture, and trees. The potential is poor to good for engineering uses.

If this soil is used as pasture or for hay, the vegetative cover is effective in controlling soil blowing and water erosion. Overgrazing can loosen the soil and reduce the cover. A proper stocking rate, pasture rotation, and timely deferment of grazing help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. The seedling survival rate can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to most sanitary facilities because of slope and the hazard of pollution of ground water due to the rapid permeability. Sealing the soil material can reduce seepage. This soil is mainly moderately well suited to building site development. Because of the steepness of the slope, land shaping generally is necessary at sites for buildings and for septic tank absorption fields unless there are areas of lesser slope within the site. Road cuts are difficult to stabilize because cutbanks cave and are low in natural fertility, but these limitations can be overcome by proper shaping and by adding suitable topsoil.

Capability subclass VIIs; woodland suitability subclass 3s.

Co—Colwood silty clay loam. This nearly level, poorly drained and very poorly drained soil is on glacial lake plains. It is subject to frequent flooding of brief duration. Areas of this map unit are irregular in shape and range from 10 to 20 acres in size. Slopes are 0 to 2 percent.

Typically, the upper part of the surface layer is black silty clay loam about 12 inches thick, and the lower part is very dark grayish brown silty clay loam about 4 inches

thick. The subsoil is about 12 inches thick. The upper part of the subsoil is grayish brown, mottled, firm silt loam; and the lower part is light olive gray, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is multicolored fine sandy loam that has thin layers of fine sand and silt. In places, the soil is moderately alkaline in the surface layer. Some uncultivated areas have a thin organic surface layer.

Included in mapping are small areas of very poorly drained Granby Variant soils and poorly drained Keowns and Pella soils. In Granby Variant soils, the lower part of the subsoil and the substratum are sandy. Keowns soils have less clay in the subsoil than the Colwood soil. Pella soils are underlain by glacial drift. The included soils are in depressions and make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate. This soil is saturated to a depth of 1.5 feet for several months during wet seasons. The surface layer is firm and must be tilled at the proper moisture content to prevent crusting and puddling. Root development is restricted by the water table.

Many areas of this soil are drained and used for row crops. Undrained areas are used for hay and as pasture and wildlife habitat. The potential is good for row crops, hay, and pasture and fair for trees. The potential is poor for most engineering uses.

If this soil is drained, it is suited to corn, soybeans, wheat, and oats. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and reduce crusting.

This soil can be used as pasture or for hay, but overgrazing or grazing when the soil is too wet can cause compaction and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil wetness generally necessitates planting by hand or machine on prepared ridges if natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid mortality. In many places, harvest is limited to periods when the soil is frozen. Harvesting by clearcutting or group selection can reduce windthrow of trees. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass 1w.

DdA—Dodge silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is in concave areas on ground moraines and convex crests of broad drumlins. Areas of this map unit are irregular in shape and range from 5 to 40 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is dark brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly loam.

Included with this soil in mapping are small areas of moderately well drained Mayville soils and well drained and moderately well drained St. Charles soils. Mayville soils and the Dodge soil formed in similar material. St. Charles soils have thicker silty layers than the Dodge soil. The included soils and the Dodge soil are in similar positions on the landscape. These included soils make up about 5 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is also good for most engineering uses.

This soil is suited to corn, small grains, and grasses and legumes for hay and pasture. It has few or no limitations for farm use. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

If this soil is used as pasture or for hay, excessive compaction and soil deterioration can be avoided by a proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings, but these limitations can be corrected by strengthening or replacing the subsoil with a suitable base material. Suitable base material is needed to help prevent damage to local roads and streets from frost action.

Capability class I; woodland suitability subclass 2o.

DdB—Dodge silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on concave foot

slopes and convex crests of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 10 to 50 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is dark brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly loam. In some areas, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of moderately well drained Mayville soils, well drained Miami soils, and well drained and moderately well drained St. Charles soils. Mayville soils and the Dodge soil formed in similar material. Miami soils have a thinner silty layer, and St. Charles soils have a thicker silty layer than the Dodge soil. The included soils and the Dodge soil are in similar positions on the landscape. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is also good for most engineering uses.

This soil is suited to corn, small grain, legumes, hay, and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Terraces and contour cultivation can be used to reduce the probability of erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings, but these limitations can be overcome by strengthening or replacing the soil with a suitable base material. A suitable base material is needed to help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass 2o.

DdC2—Dodge silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are long and narrow and range from 5 to 15 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is dark brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly loam. In some areas this soil is not eroded.

Included in mapping are small areas of moderately well drained Mayville soils and well drained and moderately well drained St. Charles soils. Mayville soils and the Dodge soil formed in similar material. St. Charles soils have a thicker silty layer than the Dodge soil. The included soils and the Dodge soil are in similar positions on the landscape. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. Some subsoil material is mixed in the plow layer, so this soil is somewhat difficult to till when wet. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a moderate hazard of erosion because of slope and past erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. This soil is suited to terraces and contour cultivation, which further limit erosion. Returning crop residue to the soil or regularly adding other organic material can help to improve fertility and increase water infiltration.

The use of the soil as pasture or for hay is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, can cause surface

compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. A suitable base material is needed to help prevent damage to local roads and streets from frost action. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and for septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

EbA—Elburn silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in concave areas on ground moraines and on foot slopes of drumlins. Areas of this map unit are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is black silt loam about 18 inches thick. The subsoil is about 30 inches thick. The upper part of the subsoil is dark grayish brown, friable silt loam; the middle part is dark brown, firm silty clay loam and brown, friable silt loam; and the lower part is dark brown, firm sandy loam. The substratum, to a depth of about 60 inches, is yellowish brown sandy loam. In places, the surface layer is thinner or lighter colored than that of the typical profile. In some areas, this Elburn soil is less than 40 inches thick over glacial till.

Included in mapping are small areas of well drained Mendota soils, poorly drained Pella soils, and well drained and moderately well drained Plano soils. These included soils and the Elburn soil formed in similar material. Plano and Mendota soils are generally higher on the landscape than the Elburn soil, and Pella soils are in slight depressions below the Elburn soil. In a few areas the Elburn soil has slope of 4 or 5 percent.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, artificial drainage is needed in some of the nearly level areas. Yields are generally higher than for most other soils in the county. Returning crop residue to the soil or regularly adding other organic material helps keep the soil in good condition.

This soil can be used as pasture or for hay. Overgrazing or grazing when the soil is too wet, however, can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture plants and the soil in good condition.

This soil is poorly suited to commercial wood production. Slow growth and poor form make trees barely merchantable. Soil-related forest management problems are minor.

This soil is poorly suited to sanitary facilities because of the high water table. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil is also poorly suited to building site development because of the high water table. If used for this purpose, the soil should be drained. A suitable base material is necessary to protect local roads and streets from damage resulting from the low strength of the soil and frost action in the soil.

Capability subclass IIw; woodland suitability subclass 4o.

Ev—Elvers silt loam. This nearly level, poorly drained and very poorly drained soil is on flood plains and on the margins of organic soils that are adjacent to mineral soils. It is subject to frequent flooding of long duration. Areas of this map unit are irregular in shape and range from 3 to 25 acres in size. Slopes range from 0 to 2 percent.

Typically, the surface layer is very dark brown silt loam about 12 inches thick. The next layer is dark grayish brown, friable silt loam about 20 inches thick. Below this is black muck about 24 inches thick. The substratum, to a depth of about 60 inches, is dark gray silt loam.

Included in mapping are small areas of poorly drained Ackmore and Pella soils. The included soils and the Elvers soil are in similar positions on the landscape, but the included soils formed entirely in silty material. Pella soils are underlain by glacial drift. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is low. This soil is saturated to a depth of 1 foot for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content; it

does, however, have a tendency to crust after heavy rain. Root development is restricted by the water table.

Many drained areas of this soil are farmed. The potential is good for cultivated crops, hay, and pasture. The potential is poor for most engineering uses.

If drained, this soil is suited to corn and small grain. It is suited to grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is poorly suited to wood production. Slow growth and poor form make trees barely merchantable. Soil wetness generally necessitates planting by hand or machine on prepared ridges if natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid mortality. Harvest is frequently limited to periods when the soil is frozen. Harvesting by clearcutting or group selection can help reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass 4w.

FoE2—Fox loam, 18 to 30 percent slopes, eroded. This moderately steep and steep, well drained soil is on terrace escarpments and on convex side slopes of pitted outwash plains, kames, and eskers. Areas of this map unit are long and narrow and range from 5 to 10 acres in size.

Typically, the surface layer is dark brown loam about 5 inches thick. The subsoil is about 17 inches thick. The upper part of the subsoil is dark brown, firm clay loam; the middle part is dark brown, firm sandy clay loam; and the lower part is dark brown, friable gravelly sandy clay loam. The substratum, to a depth of 60 inches, is yellowish brown sand and gravel. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Casco soils and excessively drained Rodman soils. Casco soils and the Fox soil are in similar positions on the landscape, but the Casco soils are thinner over sand and gravel. Rodman soils have more convex slopes and are thinner over sand and gravel. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. It has a tendency to crust after heavy rain and to puddle if tilled when too wet. Roots of most crops do not develop well in the droughty substratum.

Most areas of this soil are in hay or pasture. The potential is fair for trees and grasses and legumes for hay and pasture. The potential is poor for most engineering uses.

If this soil is used as pasture or for hay, excessive erosion and soil deterioration can be avoided by using a proper stocking rate, pasture rotation, and deferred grazing and by restricting use during wet periods.

This soil is suited to commercial wood production. Soil-related problems of forest management are steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be improved by careful planting and use of vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate natural regeneration.

This soil is poorly suited to sanitary facilities and building site development because of the steepness of the slope. This limitation can be overcome by using the included areas of lesser slope or by shaping the site. The pollution of ground water is a hazard because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. Construction of local roads and streets generally requires extensive cutting and filling. This soil does not have sufficient strength to support vehicular traffic. A suitable base material is needed to overcome this limitation. The substratum is a good source of sand and gravel.

Capability subclass VIe; woodland suitability subclass 2r.

FsA—Fox silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on glacial outwash plains and terraces. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, firm silty clay loam; the lower part is firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown sand and gravel. In places, the surface layer is loam.

Included in mapping are small areas of moderately well drained Ionia soils and well drained St. Charles,

gravelly substratum, soils. The included soils and the Fox soil are in similar positions on the landscape. St. Charles, gravelly substratum, soils are thicker over sand and gravel than the Fox soil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is slow. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content; it does, however, have a tendency to crust after heavy rain. Roots of most crops do not develop well in the droughty substratum.

Most areas of this soil are used for farming. The potential is good for row crops, hay, pasture, and trees. The potential is also good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain natural fertility and good tilth.

If this soil is used as pasture or for hay, excessive compaction and soil deterioration can be avoided by using a proper stocking rate, pasture rotation, and deferred grazing and by restricting use during wet periods.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to most sanitary facilities except septic tank absorption fields. There is a hazard of pollution of ground water because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. This soil is mainly well suited to building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings. These limitations can be corrected by strengthening or replacing the subsoil with a suitable base material. The substratum is a good source of sand and gravel.

Capability subclass IIs; woodland suitability subclass 2o.

FsB—Fox silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex side slopes of glacial outwash plains, terraces, kames, and eskers. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, firm silty clay loam; the lower part is dark yellowish brown, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown sand and gravel. In places, the surface layer is loam. In some places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained Casco soils, moderately well drained Ionia soils, and well drained St. Charles, gravelly substratum, soils. These included soils and the Fox soil are in similar positions on the landscape. Casco soils are thinner over sand and gravel than the Fox soil. St. Charles, gravelly substratum, soils are thicker over sand and gravel. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is slow or medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Roots of most crops do not develop well in the droughty substratum.

Most areas of this soil are used for farming. The potential is good for row crops, hay, pasture, and trees. The potential is also good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion because of slope. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Most areas are suitable for terracing and contour farming, which also help prevent erosion. Returning crop residue to the soil or regularly adding organic material helps to maintain natural fertility and good tilth.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to most sanitary facilities. It is suited to septic tank absorption fields, however, pollution of ground water is a hazard because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. This soil is well suited to building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic

and foundations of buildings. These limitations can be corrected by strengthening or replacing the subsoil with a suitable base material. The substratum is a good source of sand and gravel.

Capability subclass IIe; woodland suitability subclass 2o.

FsC2—Fox silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of glacial outwash plains, terraces, kames, and eskers. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, firm silty clay loam; and the lower part is dark yellowish brown, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown sand and gravel. In places, the surface layer is loam. In some areas, this soil is not eroded.

Included in mapping are small areas of well drained Casco soils and St. Charles, gravelly substratum, soils. These included soils and the Fox soil are in similar positions on the landscape. Casco soils are thinner over sand and gravel than the Fox soil. St. Charles, gravelly substratum, soils are thicker over sand and gravel. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material has been mixed into the plow layer. It has a tendency to crust after heavy rain and to puddle if tilled when too wet. Roots of most crops do not develop well in the droughty substratum.

Most areas of this soil are used for farming. The potential is fair for row crops and good for hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent further soil loss. In some areas, terraces and contour farming can further reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and reduce crusting.

The use of this soil as pasture or for hay is also effective in controlling erosion. However, overgrazing or grazing when the soil is too wet causes soil compaction and excessive runoff. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities. There is a hazard of pollution of ground water because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. This soil is suited to building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings. These limitations can be corrected by strengthening or replacing the subsoil with a suitable base material. Because of steepness of slope, land shaping may be necessary. The substratum is a good source of sand and gravel.

Capability subclass IIIe; woodland suitability subclass 2o.

FsD2—Fox silt loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is on terrace escarpments and on convex side slopes of pitted outwash plains, kames, and eskers. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, firm silty clay loam; the lower part is dark yellowish brown, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown sand and gravel. In places, the surface layer is loam. In some areas this soil is not eroded.

Included in mapping are small areas of severely eroded Fox soils, well drained Casco soils, and excessively drained Rodman soils. Casco soils and the Fox soil are in similar positions on the landscape, but the Casco soils are thinner over sand and gravel. Rodman soils have more convex slopes and are thinner over sand and gravel. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Roots of most crops do not develop well in the droughty substratum.

Most areas of this soil are farmed. The potential is poor for row crops and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is poorly suited to corn and small grain. It is suited to grasses and legumes for hay and pasture. Erosion is severe hazard.

The use of this soil as pasture or for hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, can cause surface compaction and excessive runoff. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to sanitary facilities and building site development because of the steepness of the slope. This limitation can be overcome by using the included areas of lesser slope or by land shaping. Pollution of ground water from some forms of onsite waste disposal is a hazard because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. Construction of local roads and streets generally requires extensive cutting and filling. This soil does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with suitable base material. The substratum is a good source of sand and gravel.

Capability subclass IVe; woodland suitability subclass 2r.

Fu—Fluvaquents. These nearly level, poorly drained and very poorly drained soils are on flood plains. They are frequently subject to long periods of flooding. Areas of this map unit are irregular in shape and range from 10 to 30 acres in size. Slopes are 0 to 2 percent.

Fluvaquents vary in color and in texture, but they typically consist of stratified silty and loamy layers to a depth of about 60 inches. In places, there are sandy layers. Organic layers are common in some areas of these soils.

Included in mapping are small areas of poorly drained Otter and Pella soils. Otter soils and Fluvaquents are in similar positions on the landscape, and Pella soils are in depressions bordering flood plains. Otter soils are silty throughout, and Pella soils are silty and are underlain by glacial drift. The included soils make up about 15 percent of this map unit.

The rate of movement of water and air through these soils is variable but is mainly moderate. Surface runoff in cultivated areas is slow. The shrink-swell potential is variable. The available water capacity is variable, and natural fertility is medium. These soils are saturated at or near the surface throughout the year. Root development is restricted by the water table.

These soils are used mainly as pasture. The potential is good for pasture, and generally poor for trees. The potential is poor for engineering uses.

If these soils are used as pasture, overgrazing or grazing when these soils are too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

These soils are too variable to classify for woodland suitability. Wetness and a hazard of flooding can limit the use of planting and harvesting equipment.

These soils are poorly suited to building site development and sanitary facilities because of wetness and the hazard of flooding.

Capability subclass Vw; woodland suitability subclass not assigned.

FxC3—Fox soils, 6 to 12 percent slopes, severely eroded. These sloping, well drained soils are on terrace escarpments and on convex side slopes of kames and eskers. In some places, the original surface layer has been entirely removed by erosion or is very thin. Areas of this map unit are irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is brown, firm clay loam about 8 inches thick. The subsoil is firm clay loam about 18 inches thick. The upper part of the subsoil is brown, and the lower part is dark yellowish brown. The substratum, to a depth of about 60 inches, is yellowish brown sand and gravel. In places, the surface layer is loam or silty clay loam.

Included in mapping are small areas of well drained Casco soils, areas of Fox soils that have slopes of more than 12 percent, and eroded Fox soils that have a silt loam surface layer. Casco soils and the Fox soils are in similar positions on the landscape, but the Casco soils are thinner over sand and gravel. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is low. The shrink-swell potential is moderate in the subsoil and low in the substratum. The organic matter content of the plow layer is low. The surface layer is firm and can be tilled only within a narrow range in moisture content without puddling and forming clods. Roots of most crops do not develop well in the droughty substratum.

Most areas of these soils are used for hay and as pasture. The potential is poor for row crops and fair for hay, pasture, and trees. The potential is fair for most engineering uses.

These soils are poorly suited to corn and small grain. They are suited to grasses and legumes for hay and

pasture. If these soils are used for cultivated crops, erosion is a severe hazard. Minimum tillage and winter cover crops help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and keep these soils in good condition.

These soils are suited to grasses and legumes for hay and pasture. If they are used as pasture, overgrazing or grazing when the soils are too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

These soils are suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

These soils are mainly poorly suited to sanitary facilities. There is a hazard of pollution of ground water because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. These soils are suited to building site development if proper design and installation procedures are used. They do not have sufficient strength and stability to support vehicular traffic and foundations of buildings. These limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Because of steepness of slope, land shaping may be necessary. The substratum is a good source of sand and gravel.

Capability subclass IVe; woodland suitability subclass 2o.

Gb—Granby Variant fine sandy loam. This nearly level, very poorly drained soil is on terraces and in glacial lake basins. It is frequently subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 5 to 40 acres in size. Slopes are 0 to 2 percent.

Typically, the surface layer is black fine sandy loam. The subsoil is about 22 inches thick. The upper part of the subsoil is dark gray, friable loam; the lower part is olive gray, very friable fine sand. The substratum, to a depth of about 60 inches, is light olive brown sand. In places, the surface layer is sandy loam, loam, loamy fine sand, loamy sand, or muck.

Included in mapping are small areas of poorly drained Keowns soils and somewhat poorly drained Kibbie soils. These soils are in slightly higher positions on the landscape than the Granby Variant soil. Keowns soils are mainly silty, and Kibbie soils are loamy throughout. These included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through the upper part of this soil and at a rapid rate through the lower part. Surface runoff in cultivated areas is slow or ponded. The available water capacity is low, and natural fertility is low. The shrink-swell potential is low. This soil is saturated to a depth of 1 foot for many months. Root development is restricted by the water table.

Some drained areas of this soil are farmed. The potential is fair for cultivated crops, hay, pasture, and trees. The potential is poor for engineering uses.

If drained, this soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keep the soil in good condition.

If this soil is used as pasture, overgrazing, grazing when the soil is too wet, or the use of heavy machinery can cause surface compaction and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil wetness and a high water table during the tree planting season limit reforestation to natural regeneration. Harvesting with heavy equipment is confined to periods when the soil is frozen. Harvesting by clearcutting or area selection prevents serious windthrow of trees. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIIw; woodland suitability subclass 3w.

HnB—Hochheim silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex crests and side slopes of drumlins. Areas of this map unit are long and narrow in shape and range from 5 to 60 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is brown and dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown and pale brown gravelly loam. In places, the surface layer is loam. In some places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of Hochheim soils that have slopes of less than 2 percent and areas of a soil that is similar to this Hochheim soil but is moderately well drained. Also included are somewhat poorly drained Nenno soils and well drained Theresa soils. Nenno soils and the Hochheim soil formed in similar material but the Nenno soils are on foot slopes below the Hochheim soil. Theresa soils and the Hochheim soil are in similar positions on the landscape, but the Theresa soils have thicker silty layers. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow or moderate rate through this soil. Surface runoff in cultivated areas is

medium. The available water capacity is moderate, and natural fertility is medium. The shrink swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is fair for row crops and good for hay, pasture, and trees. The potential is good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Terracing can be used to help control erosion, but care must be taken to prevent exposure of the moderately alkaline substratum. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is suited to most sanitary facilities and to building site development if proper design and installation procedures are used. In areas where it is moderately slowly permeable, it is poorly suited to use as septic tank absorption fields. It does not have sufficient strength to support vehicular traffic, but this limitation can be corrected by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets resulting from frost action in the soil.

Capability subclass IIe; woodland suitability subclass 2o.

HnC2—Hochheim silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of drumlins. Areas of this map unit are long and narrow and range from 3 to 25 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is brown and dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown and pale brown gravelly loam. In places, the surface layer is loam. In some areas this soil is not eroded.

Included in mapping are small areas of Hochheim soils that are moderately well drained and areas of somewhat poorly drained Nenno soils and well drained Theresa soils. Nenno soils and the Hochheim soil formed in similar material, but Nenno soils are on foot slopes of drumlins and ground moraines. Theresa soils and the Hochheim soil are in similar positions on the landscape, but Theresa soils are thicker over glacial till. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow or moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. It has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is fair for row crops, good for hay and pasture, and fair for trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a moderate hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Terraces and contour farming can be used to further reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is suited to most sanitary facilities and to building site development if proper design and installation procedures are used. In areas where it is moderately slowly permeable, it is poorly suited to use as septic tank absorption fields. It does not have sufficient strength to support vehicular traffic, but this limitation can be corrected by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets resulting from frost action in the soil. Because of the steepness of slope, land shaping may be necessary for building sites and septic tank absorption fields unless included areas of lesser slope are available.

Capability subclass IIIe; woodland suitability subclass 2o.

HnD2—Hochheim silt loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil

is on convex side slopes of drumlins. Areas of this map unit are long and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is brown and dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown and pale brown gravelly loam. In places, the surface layer is loam. In some areas this soil is not eroded.

Included in mapping are small areas of moderately well drained soils that are similar to Hochheim soils and areas of Hochheim soils that are severely eroded. Also included are small areas of well drained Theresa soils. Theresa soils and the Hochheim soil are in similar positions on the landscape, but the Theresa soils are thicker over glacial till. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow or moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is poor for row crops, good for hay and pasture, and fair for trees. The potential is poor for most engineering uses.

This soil is poorly suited to corn and small grain. It is suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a severe hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to sanitary facilities and building site development because of the steepness of slope. This limitation can be overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling.

Capability subclass IVe; woodland suitability subclass 2r.

HnE2—Hochheim silt loam, 18 to 30 percent slopes, eroded. This steep, well drained soil is on convex side slopes of drumlins and moraines. Areas of this map unit are long and narrow and range from 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is dark brown and brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown and pale brown gravelly loam. In some areas this soil is not eroded.

Included in mapping are small areas of Hochheim soils that have slopes of less than 18 percent and severely eroded Hochheim soils. Also included are small areas of Theresa soils. Theresa soils and the Hochheim soil are in similar positions on the landscape, but the Theresa soils are thicker over glacial till. The included soils make up about 5 percent of the map unit.

Water and air move at a moderately slow or moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are in hay or pasture. The potential is poor for row crops, fair for hay and pasture, and fair for trees. The potential is poor for most engineering uses.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet, however, can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be improved by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to sanitary facilities and building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling.

Capability subclass VIe; woodland suitability subclass 2r.

HoD3—Hochheim soils, 12 to 18 percent slopes, severely eroded. These moderately steep soils are on convex side slopes of drumlins. The original surface layer has been entirely removed by erosion. In places, most of the upper part of the subsoil has been lost. Areas of this map unit are long and narrow and range from 3 to 12 acres in size.

Typically, the surface layer is brown, firm clay loam about 5 inches thick. The subsoil is dark brown, firm clay loam about 5 inches thick. The substratum, to a depth of about 60 inches, is brown and pale brown gravelly loam. In places, the surface layer is loam or sandy clay loam.

Included in mapping are small areas of eroded Hochheim soils that have a loam surface layer. These included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow or moderate rate through these soils. Surface runoff in cultivated areas is rapid. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The organic matter content of the surface layer is low. The surface layer is firm and can be tilled only within a narrow range of moisture content without puddling and forming clods.

Most areas of these soils are used for hay or as pasture. The potential is poor for row crops and fair for hay, pasture, and trees. The potential is poor for most engineering uses.

These soils are suited to grasses and legumes for hay and pasture. Overgrazing and grazing when the soils are too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

These soils are suited to commercial wood production. Soil-related problems of forest management are the steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

These soils are poorly suited to sanitary facilities and building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by land shaping. Construction of local roads and streets generally requires extensive cutting and filling.

Capability subclass VIe; woodland suitability subclass 2r.

Hu—Houghton muck. This nearly level, very poorly drained soil is in depressions on lake plains and moraines (fig. 6). It is subject to frequent flooding of long duration. Areas of this map unit are irregular in shape and range from 20 to 1,000 acres in size. Slopes are 0 to 2 percent.

Typically, the organic layers are black, dark reddish brown, and dark grayish brown muck to a depth of about 60 inches. In places, the lower layer is sedimentary peat.

Included in mapping are small areas of very poorly drained Adrian Variant and Palms soils. These included soils and Houghton muck are in similar positions on the landscape, but the included soils have thinner organic layers. These inclusions make up about 15 percent of the map unit.

Water and air move at a moderately rapid rate through this soil. Surface runoff in cultivated areas is very slow or ponded. The available water capacity is very high, and natural fertility is low. This soil is saturated to a depth of 1 foot for many months. The organic layer is friable and easily tilled throughout a wide range in moisture content. Root development is restricted by the water table.

Undrained areas of this soil are used mainly as wildlife habitat or for marsh hay. Drained areas are used for corn and canning crops. The potential is good for these crops and fair for trees. The potential is poor for most engineering uses.

If this soil is drained and cultivated, soil blowing and subsidence become a problem. Windbreaks and cover crops reduce soil blowing, and controlled drainage reduces the rate of subsidence.

This soil is suited to commercial wood production. Soil wetness and the high water table during the tree planting season limit reforestation to natural regeneration. Harvesting with heavy equipment is restricted to periods when the soil is frozen. Harvesting by clearcutting or area selection prevents serious windthrow of trees. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIIw; woodland suitability subclass 3w.

Figure 6.—Typical area of Houghton muck and Houghton muck, ponded, in the Horicon National Wildlife Refuge.

Hw—Houghton muck, ponded. This nearly level, very poorly drained soil is in depressions on lake plains (fig. 6). It is subject to frequent flooding of very long duration. This soil is undrained and covered by shallow water. Areas of this map unit are irregular in shape and range from 500 to 3,000 acres in size. Slopes are 0 to 2 percent.

Typically, the organic layers are black, dark reddish brown, and dark grayish brown muck to a depth of about 60 inches.

Included in mapping are small areas of Houghton muck and Palms soils. Palms soils are underlain by silty clay loam at a depth of 16 to 51 inches. Houghton muck is covered by water for shorter periods than Houghton muck, ponded, or not at all. These inclusions and Houghton muck, ponded, are in similar positions on the landscape. The inclusions make up about 15 percent of the map unit.

If this soil is drained, water and air move through it at a moderately rapid rate. Surface runoff is ponded. The available water capacity is very high, and natural fertility is low. This soil is covered with water most of the year. The organic layer is friable and easily tilled throughout a wide range in moisture content. Root development is restricted by the water table.

All areas of this soil are undrained and are used as wildlife habitat. The potential is good for wetland wildlife habitat. If the soil is drained, the potential is good for corn and canning crops and fair for trees.

If drained, this soil is suited to commercial wood production. Soil wetness and the high water table during the tree planting season limit reforestation to natural regeneration. Harvesting with heavy equipment is confined to periods when the soil is frozen. Harvesting by clearcutting or area selection reduces the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is not suited to sanitary facilities and building site development because of standing water.

Capability subclass VIIIw, undrained; woodland suitability subclass not assigned.

IoA—Ionia silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is in concave areas on glacial outwash terraces. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is dark brown, mottled, firm silty clay loam; the lower part is dark brown, mottled, firm gravelly clay loam. The substratum, to a depth of about 60 inches, is pale brown sand and gravel. In places, the surface layer is loam or sandy loam or is darker colored than in the typical profile.

Included in mapping are areas of Ionia soils that have slopes of 4 percent and small areas of well drained Fox

soils. Fox soils and this Ionia soil formed in similar material, but Fox soils are slightly higher on the landscape. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is slow. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 2 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Roots of many crops do not develop well in the sand and gravel substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair to poor for most engineering uses.

This soil is suited to corn, small grains, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keeps the soil in good condition.

If this soil is used as pasture and for hay, overgrazing or grazing when the soil is too wet can cause soil compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities because of wetness and seepage. There is a hazard of pollution of ground water from some sanitary facilities because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. The suitability for septic tank absorption fields can be improved by building a filtering mound or by providing drainage to lower the water table. This soil has fair or poor suitability for building site development. If used for this purpose, the soil should be drained. This soil does not have sufficient strength and stability to support vehicular traffic and dwellings without basements. These limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. This practice will also reduce damage to local roads and streets that results from frost action in the soil. The substratum is a good source of sand and gravel.

Capability subclass IIs; woodland suitability subclass 1o.

JuA—Juneau silt loam, 0 to 2 percent slopes. This nearly level, well drained and moderately well drained soil is on foot slopes of drumlins and ground moraines and in drainageways. It is occasionally subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The next layer is dark brown and very dark grayish brown, friable silt loam about 34 inches thick. The layer below that is dark brown, friable silty clay loam about 14 inches thick. Brown, firm clay loam extends to a depth of about 60 inches.

Included in mapping are small areas of somewhat poorly drained Elburn soils, moderately well drained Mayville soils, and well drained and moderately well drained St. Charles soils. These soils are on ground moraines and drumlins and are underlain by glacial till. They make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the lower part of the profile. In some areas this soil is saturated to a depth between 3 and 6 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are used for farming. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to maintain fertility and increase water infiltration.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, and excessive use of machinery can result in surface compaction and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the hazard of flooding. Diversions, dams, or levees can reduce this hazard. In some areas where the water table is high, this soil needs to be drained. This soil does not have sufficient strength to support vehicular traffic, but this limitation can be corrected by strengthening or replacing the soil with suitable base material.

Capability class I; woodland suitability subclass 2o.

JuB—Juneau silt loam, 2 to 6 percent slopes. This gently sloping, well drained and moderately well drained

soil is on concave foot slopes of drumlins and ground moraines. It is occasionally subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The next layer is dark brown and very dark grayish brown, friable silt loam about 34 inches thick. The layer below that is dark brown, friable silty clay loam about 14 inches thick. Brown, firm clay loam extends to a depth of about 60 inches.

Included in mapping are small areas of somewhat poorly drained Elburn soils, moderately well drained Mayville soils, and well drained and moderately well drained St. Charles soils. These soils are on ground moraines and on drumlins and are underlain by glacial till. They make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the lower part of the profile. In some areas this soil is saturated to a depth between 3 and 6 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses because of flooding.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain fertility and increase the water infiltration rate.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, and excessive use of machinery can result in surface compaction and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the hazard of flooding. Diversions, dams, or levees can reduce that hazard. In some areas where the water table is high, this soil needs to be drained. This soil does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the soil with suitable base material.

Capability subclass IIe; woodland suitability subclass 2o.

Ke—Keowns silt loam. This nearly level, poorly drained soil is on stream terraces and on glacial lake plains. It is frequently subject to brief periods of flooding. Areas of this map unit are irregular or long and narrow and range from 5 to 50 acres in size. Slopes are 0 to 2 percent.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 5 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is light brownish gray, friable silt loam; the lower part is multicolored, stratified silt loam and fine sand. The substratum, to a depth of about 60 inches, is multicolored fine sand, sand, and silt loam. In places, the surface layer is loam, fine sandy loam, or muck.

Included in mapping are small areas of somewhat poorly drained Kibbie soils, poorly drained Pella soils, and well drained Sisson soils. Kibbie soils have more clay in the subsoil and are higher on the landscape than the Keowns soil. Pella soils are underlain by glacial drift. Sisson soils have more clay in the subsoil and are higher on the landscape than the Keowns soil. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is low. This soil is saturated to a depth of 1 foot for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Where artificial drainage is feasible, this soil is farmed. The potential is fair for row crops, hay, and pasture and good for trees. The potential is poor for most engineering uses.

If artificially drained, this soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Drainage is difficult because of the high content of fine sand and silt, which clog the tiles. Returning crop residue to the soil or regularly adding other organic material can help to improve fertility and keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, and excessive use of machinery can result in surface compaction and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Because of soil wetness, planting by hand or machine on prepared ridges generally is necessary if natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid seedling mortality. Harvest is frequently limited to periods when the soil is frozen. Harvesting by clearcutting or group selection can help reduce windthrow of trees. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIIw; woodland suitability subclass 1w.

KIA—Kibbie loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream terraces and in glacial lake basins. It is rarely subject to flooding. The areas are irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is dark brown, mottled, firm loam; the lower part is dark brown, mottled, firm sandy clay loam. The substratum, to a depth of about 60 inches, is grayish brown, mottled silt loam in the upper 6 inches and dark grayish brown, mottled fine sand in the lower part. In places, the surface layer is silt loam or fine sandy loam. In some places, the subsoil is sandy loam.

Included in mapping are small areas of poorly drained Keowns and well drained Sisson soils. Keowns soils contain less clay in the subsoil than the Kibbie soil. Sisson soils and the Kibbie soil formed in similar materials, but Sisson soils are higher on the landscape. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is low. This soil is saturated to a depth of 1 to 2 feet for many months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops if the soil is drained and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, artificial drainage is beneficial. Returning crop residue to the soil or regularly adding other organic material helps to maintain fertility and the water infiltration rate.

Undrained areas are commonly used as pasture. Overgrazing or grazing when the soil is too wet, however, can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil is also poorly suited to building site development. If used for this purpose, the soil should be drained, and diversions should be used to protect the site from flooding. A suitable base material is needed to protect local roads and streets from damage resulting from the low strength of the soil and frost action in the soil.

Capability subclass IIw; woodland suitability subclass 2o.

KIB—Kibbie loam, 2 to 6 percent slopes. This gently sloping, somewhat poorly drained soil is in concave areas on stream terraces and on the border of glacial lake plains. It is subject to rare flooding. The areas are irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is dark brown, mottled, firm loam; the lower part is dark brown, mottled, firm sandy clay loam. The substratum, to a depth of about 60 inches, is grayish brown, mottled silt loam in the upper 6 inches and dark grayish brown, mottled fine sandy loam in the lower part. In places, the surface layer is silt loam or fine sandy loam.

Included in mapping are small areas of poorly drained Keowns and well drained Sisson soils. Keowns soils have less clay in the subsoil than the Kibbie soil. Sisson soils and the Kibbie soils formed in similar material, but the Sisson soils are higher on the landscape. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is low. This soil is saturated to a depth of 1 to 2 feet for many months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops if the soil is drained and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

Where artificial drainage systems have not been installed, the soil is commonly used as pasture or for hay. Overgrazing or grazing when the soil is too wet, however, can cause surface compaction, excessive

runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil is also poorly suited to building site development. If used for this purpose, the soil should be drained, and diversions should be used to prevent flooding. A suitable base material is necessary to protect local roads and streets from damage resulting from the low strength of the soil and frost action in the soil.

Capability subclass IIe; woodland suitability subclass 2o.

KrB—Kidder loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex side slopes and crests of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable sandy clay loam; the lower part is brown, firm loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly sandy loam. In some areas, the surface layer is silt loam or fine sandy loam. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained McHenry and Miami soils. These included soils and the Kidder soil are in similar positions on the landscape. McHenry soils have a thicker layer of silty material over glacial till than the Kidder soil, and Miami soils have slightly more clay in the subsoil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a moderate hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Some areas have slopes that are long and smooth enough for terracing and contour farming. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of excessive seepage. It can be used for septic tank absorption fields. Sealing the soil material reduces seepage. This soil is suited to building site development if proper design and installation procedures are used. It does not have sufficient strength or stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Replacing the soil with suitable base material can help prevent damage to roads and streets that results from frost action.

Capability subclass IIe; woodland suitability subclass 2o.

KrC2—Kidder loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is brown, friable sandy clay loam; the lower part is brown, firm loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly sandy loam. In places, the surface layer is silt loam or fine sandy loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained McHenry and Miami soils. These included soils and the Kidder soil are in similar positions on the landscape. McHenry soils have a thicker silty layer than the Kidder soil, and Miami soils have slightly more clay in the subsoil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is

friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is fair for row crops and good for small grain, grasses, legumes, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for pasture and hay. If this soil is used for cultivated crops, erosion is a hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities. There is a hazard of pollution of ground water because of the moderately rapid permeability of the substratum. Sealing the soil material can reduce seepage. This soil is suited to building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action. Because of the steepness of slope, land shaping may be necessary for building sites and septic tank absorption fields unless included areas of lesser slope are available.

Capability subclass IIIe; woodland suitability subclass 2o.

KrD2—Kidder loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is brown, friable sandy clay loam; the lower part is brown, firm loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly sandy loam. In places, the surface layer is silt loam or fine sandy loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained McHenry and Miami soils. These included soils and the Kidder soil are in similar positions on the landscape. McHenry soils have a thicker silty layer than the Kidder soils, and Miami soils have slightly more clay in the subsoil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

A few areas of this soil are farmed. The potential is fair for row crops that are grown occasionally in rotation and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a severe hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to sanitary facilities and building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. Pollution of ground water by some sanitary facilities is a hazard because of the

moderately rapid permeability of the substratum. Sealing the soil material can reduce seepage.

Capability subclass IVe; woodland suitability subclass 2r.

KrE2—Kidder loam, 18 to 30 percent slopes, eroded. This steep, well drained soil is on convex side slopes of drumlins and moraines. Areas of this map unit are long and narrow and range from 3 to 10 acres in size.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil is about 19 inches thick. The upper part of the subsoil is brown, friable sandy clay loam; the lower part is brown, firm loam. The substratum, to a depth of about 60 inches, is gravelly sandy loam. In places, the surface layer is silt loam or fine sandy loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained McHenry and Miami soils. These included soils and the Kidder soil are in similar positions on the landscape. McHenry soils have a thicker silty layer than the Kidder soil, and Miami soils have slightly more clay in the subsoil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Very few areas of this soil are farmed. The potential is poor for row crops and hay, fair for pasture, and good for trees. The potential is poor for most engineering uses.

This soil is suited to grasses for pasture. Overgrazing or grazing when the soil is too wet, however, can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to sanitary facilities and building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. There is a hazard of pollution of ground water from some forms of onsite waste disposal because of the moderately rapid permeability of the substratum. Sealing the soil material can reduce seepage.

Capability subclass VIe; woodland suitability subclass 2r.

KwA—Knowles silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on ground moraines that are underlain by dolomite bedrock at a depth of 20 to 40 inches. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 10 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil is about 13 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the lower part is dark brown, firm loam. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In places, the surface layer is thicker and darker colored than in the typical profile. In some areas, this soil formed entirely in silty material.

Included in mapping are small areas of somewhat poorly drained Knowles Variant soils, well drained Lomira soils, and well drained and moderately well drained St. Charles soils. Knowles Variant soils and this Knowles soil formed in similar material, but Knowles Variant soils are lower on the landscape. Lomira and St. Charles soils and this Knowles soil are in similar positions on the landscape. Lomira and St. Charles soils are underlain by glacial till. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is moderate, and natural fertility is high. The shrink-swell potential is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted below a depth of 20 to 40 inches by dolomite bedrock. In places, however, roots grow into soil-filled crevices in the dolomite.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

If this soil is used as pasture or for hay, excessive compaction and soil deterioration can be avoided by using a proper stocking rate, pasture rotation, and deferred grazing and by restricting use during wet periods.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of depth to bedrock. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil has fair or poor suitability for building site development because of depth to bedrock and the lack of stability to support dwellings without basements. Poor stability can be overcome by replacing the subsoil with a suitable base material. Adding a suitable base material can also help prevent damage to local roads and streets that results from frost action in the soil.

Capability subclass IIs; woodland suitability subclass 2o.

KwB—Knowles silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex side slopes of ground moraines that are underlain by dolomite bedrock at a depth of 20 to 40 inches. Areas of this map unit are irregular in shape and range from 10 to 35 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 10 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil is about 13 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; and the lower part is dark brown, firm loam. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In places, the surface layer is thicker and darker colored than in the typical profile. In some areas, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil. In places, this soil formed entirely in silty material.

Included in mapping are small areas of well drained Lomira soils and well drained and moderately well drained St. Charles soils. These included soils and the Knowles soil are in similar positions on the landscape. Lomira and St. Charles soils are underlain by glacial till. They make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is moderate, and natural fertility is high. The shrink-swell potential is moderate. The surface layer is friable and easily tilled throughout a wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted below a depth of 20 to 40 inches by dolomite bedrock. In places, however, roots grow into soil-filled crevices in the dolomite.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Terracing is difficult because of the depth to bedrock. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of depth to bedrock. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil has fair or poor suitability for building site development because of depth to bedrock and the lack of stability to support dwellings without basements. Poor stability can be overcome by replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass 2o.

KwC2—Knowles silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of ground moraines that are underlain by dolomite bedrock at a depth of 20 to 40 inches. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 13 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the lower part is dark brown, firm loam. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In places, the surface layer is thicker and darker colored than in the typical profile. In some areas this soil is not eroded. In places, this soil formed entirely in silty material.

Included in mapping are small areas of well drained Lomira and St. Charles soils. These included soils and the Knowles soil are in similar positions on the landscape. Lomira and St. Charles soils are underlain by glacial till. They make up about 15 percent of the map unit.

Water and air move at a moderate rate through the soil. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is high. The shrink-swell potential is moderate. The

surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development is restricted below a depth of 20 to 40 inches by the dolomite bedrock. In places, however, roots grow into soil-filled crevices in the dolomite.

Most areas of this soil are farmed. The potential is fair for row crops and good for pasture, hay, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, however, there is a severe hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of bedrock and slope. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil generally is poorly suited to building site development because of depth to bedrock, slope, and the lack of stability to support dwellings without basements. Poor stability can be overcome by replacing the subsoil with suitable base material. Adding suitable base material can also help prevent damage to local roads and streets from frost action. Because of the steepness of slope, land shaping may be necessary if included areas of lesser slope are not available. Land shaping may expose bedrock and create more problems.

Capability subclass IIIe; woodland suitability subclass 2o.

KxA—Knowles Variant silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is in depressions on ground moraines that are underlain by dolomite bedrock at a depth of 20 to 40 inches. It is occasionally subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 17 inches thick. The upper part of the subsoil is dark brown, mottled, firm silty clay loam; the lower part is dark brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In places, the soil formed entirely in silty material.

Included in mapping are small areas of well drained Knowles soils. These soils and the Knowles Variant soil formed in similar material, but the included soils are higher on the landscape. The included soils make up about 5 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is moderate, and natural fertility is high. The shrink-swell potential is moderate. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted by the water table or by the dolomite bedrock.

Most areas of this soil are farmed. The potential is fair for row crops, and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and depth to bedrock. The suitability for septic tank absorption fields can be improved by building a filtering mound. If this soil is used for building site development, the site should be drained, and diversions should be used to protect the site from flooding. Filling with a suitable base material is necessary to protect local roads and streets from the damage caused by frost action.

Capability subclass IIw; woodland suitability subclass 2o.

KxB—Knowles Variant silt loam, 2 to 6 percent slopes. This gently sloping, somewhat poorly drained

soil is in concave depressions and in seepage areas of ground moraines that are underlain by dolomite bedrock at a depth of 20 to 40 inches. It is subject to occasional flooding of brief duration. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is about 17 inches thick. The upper part of the subsoil is dark brown, mottled, firm silty clay loam; the lower part is dark brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In places, the soil formed entirely in silty material.

Included in mapping are small areas of well drained Knowles soils. These soils formed in similar material but are mainly higher on the landscape than the Knowles Variant soil. They make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is high. The shrink-swell potential is moderate. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted by the water table or by the dolomite bedrock.

Most areas of this soil are farmed. The potential is fair for row crops and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage and winter cover crops help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keeps the soil in good condition.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and depth to bedrock. The suitability for septic tank absorption fields can be improved by building a filtering mound. If this soil is used for building site development, the site should be drained, and diversions should be used to protect the site from flooding. A suitable base material is necessary to protect local roads and streets from the damage caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

LmA—Lamartine silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on foot slopes of ground moraines and drumlins and on the crests of wide drumlins. It is subject to occasional flooding of very brief duration. Areas of this map unit are irregular in shape and range from 5 to 40 acres in size.

Typically, the upper part of the surface layer is very dark grayish brown silt loam about 8 inches thick, and the lower part is grayish brown silt loam about 3 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is dark brown, mottled, friable silt loam; the middle part is dark yellowish brown, mottled, firm silty clay loam; and the lower part is brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled loam. In places, the substratum contains stones and cobblestones.

Included in mapping are small areas of somewhat poorly drained Elburn soils, well drained and moderately well drained Juneau soils, and moderately well drained Mayville soils. Elburn and Mayville soils and the Lamartine soil formed in similar material. Elburn soils and the Lamartine soil are in similar positions on the landscape, and Mayville soils are higher on the landscape. Juneau soils are on foot slopes and flood plains and have a silty substratum. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. It can be used for cultivated crops without artificial drainage, but drainage is beneficial in most areas. Returning crop residue to the soil and regularly adding other organic material can help to improve fertility and keep the soil in good condition.

If this soil is used as pasture, overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with

natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table and flooding. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil is also poorly suited to building site development. If this soil is used for this purpose, the site should be drained, and diversions should be used to protect the site from flooding. Replacing the soil with a suitable base material is necessary to protect local roads and streets from the damage that results from frost action in the soil.

Capability subclass IIw; woodland suitability subclass 2o.

LmB—Lamartine silt loam, 2 to 6 percent slopes. This gently sloping, somewhat poorly drained soil is on concave foot slopes of ground moraines and drumlins. It is subject to occasional flooding of very brief duration. Areas of this map unit are long and narrow and range from 5 to 30 acres in size.

Typically, the upper part of the surface layer is very dark grayish brown silt loam about 7 inches thick, and the lower part is grayish brown silt loam about 3 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is dark brown, mottled, friable silt loam; the middle part is dark yellowish brown, mottled, firm silty clay loam; and the lower part is brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled loam. In places, the original surface layer is covered with colluvial material that has been washed from adjacent upper slopes.

Included in mapping are small areas of somewhat poorly drained Elburn soils, well drained and moderately well drained Juneau soils, and moderately well drained Mayville soils. Elburn and Mayville soils and the Lamartine soil formed in similar material. Elburn soils and the Lamartine soil are in similar positions on the landscape, and Mayville soils are higher on the landscape. Juneau soils are on foot slopes and flood plains and have a silty substratum. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a slight hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

If this soil is used as pasture and for hay, overgrazing, grazing when the soil is too wet, or the use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table. The suitability for septic tank absorption fields, however, can be improved by building a filtering mound. This soil is also poorly suited to building site development. If this soil is used for this purpose, the site should be drained, and diversions should be used to protect the site from flooding. Replacing the soil with a suitable base material is necessary to protect local roads and streets from the damage that results from frost action in the soil.

Capability subclass IIe; woodland suitability subclass 2o.

LrB—LeRoy silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in convex areas on ground moraines and on crests and upper side slopes of drumlins. Areas of this map unit are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 13 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown gravelly loam. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of somewhat poorly drained Elburn soils and well drained and moderately well drained St. Charles soils. The included soils and the LeRoy soil are in similar positions on the landscape, but the included soils have a thicker layer of silty material. These included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to

crust after heavy rain. Root development is somewhat limited below a depth of about 12 to 24 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material can help to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient stability to support vehicular traffic and foundations of buildings, but this limitation can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass 2o.

LrC2—LeRoy silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is in convex areas on ground moraines and on side slopes of drumlins. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 13 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown gravelly loam. In some areas this soil is not eroded.

Included in mapping are small areas of severely eroded LeRoy soils that have a silty clay loam surface layer and areas of well drained and moderately well drained St. Charles soils. St. Charles soils and this LeRoy soil are in similar positions on the landscape, but St. Charles soils have a thicker layer of silty material. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and puddle if tilled when too wet. Root development is somewhat limited below a depth of about 12 to 24 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is fair for row crops, hay, and pasture and good for trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture; yields are lower in eroded areas than they are in uneroded areas. If this soil is used for cultivated crops, there is a hazard of further erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient stability to support vehicular traffic or foundations of buildings, but this limitation can be overcome by strengthening or replacing the subsoil with suitable base material. Adding suitable base material can help prevent damage to local roads and streets from frost action. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and for septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

LrD2—LeRoy silt loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is in convex areas on ground moraines and on moraine knolls and ridges. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 12

inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown gravelly loam. In places, the surface layer is thicker and darker colored than in the typical profile. In some areas this soil is not eroded.

Included in mapping are small areas of severely eroded LeRoy soils that have a silty clay loam surface layer and well drained Lomira and Markesan soils. These included soils and the LeRoy soil are in similar positions on the landscape. Lomira soils have a thicker silty layer than the LeRoy soil, and Markesan soils have a darker colored or thicker surface layer. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development is somewhat limited below a depth of about 12 to 24 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is fair for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be avoided or overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling.

Capability subclass IVe; woodland suitability subclass 2r.

LrE2—LeRoy silt loam, 18 to 30 percent slopes, eroded. This steep, well drained soil is on convex side slopes of moraine ridges. Areas of this map unit are long and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 12 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown gravelly loam. In some areas this soil is not eroded.

Included in mapping are small areas of severely eroded LeRoy soils that have a silty clay loam or clay loam surface layer and are less than 12 inches thick over the underlying glacial till. These inclusions make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. It has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development is somewhat limited below a depth of about 12 to 24 inches by the high lime content of the substratum.

Most areas of this soil are in pasture, hay, or woodland. The potential is very poor for row crops and fair for hay, pasture, and trees. The potential is poor for most engineering uses.

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

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting operations can expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be avoided or overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling.

Capability subclass VIe; woodland suitability subclass 2r.

LvB—Lomira silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in convex areas on ground moraines. Areas of this map unit are irregular in shape and range from 5 to 50 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark brown, firm silty clay loam; and the lower part is dark brown and brown, friable sandy clay loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly loam. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained Knowles soils and well drained and moderately well drained St. Charles soils. These included soils and the Lomira soil are in similar positions on the landscape. Knowles soils are underlain by dolomite bedrock at a depth of 20 to 40 inches. St. Charles soils have a thicker layer of silty material than the Lomira soil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is somewhat limited below a depth of about 20 to 40 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is also good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass 2o.

LvC2—Lomira silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is in convex areas on ground moraines. Areas of this map unit are irregular in shape and range from 5 to 30 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 6 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark brown, firm silty clay loam; and the lower part is dark brown and brown, friable sandy clay loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly loam. In some areas this soil is not eroded.

Included in mapping are small areas of Lomira soils that have slopes of more than 12 percent and small areas of well drained and moderately well drained St. Charles soils. St. Charles soils and the Lomira soil are in similar positions on the landscape, but St. Charles soils have a thicker layer of silty material. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development is somewhat limited below a depth of about 20 to 40 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for

cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting operations can expose sufficient mineral soil to allow adequate regeneration.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Adding suitable base material can help prevent damage to local roads and streets from frost action. Because of the steepness of slope, land shaping may be necessary at sites for buildings and septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

MdB—Markesan silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in convex areas on moraines and drumlins. Areas of this map unit are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsoil is about 11 inches thick. The upper part of the subsoil is brown, friable silt loam; the lower part is dark brown, firm silty clay loam. The substratum, to a depth of about 60 inches, is yellowish brown gravelly loam in the upper 4 inches and brown gravelly loam in the lower part. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil. In some areas, there are dolomite fragments throughout the soil.

Included in mapping are small areas of well drained Mendota soils. Mendota soils and the Markesan soil are in similar positions on the landscape, but Mendota soils are deeper to underlying glacial till. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. Root development is somewhat limited below a depth of about 12 to 24 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce soil erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is not naturally forested; therefore, it generally is not managed for woodland.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient stability to support vehicular traffic or foundations of buildings, but this limitation can be overcome by strengthening or replacing the subsoil with suitable base material. Adding suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass not assigned.

MdC2—Markesan silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is in convex areas on moraines and drumlins. Areas of this map unit are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark brown silt loam about 7 inches thick. The subsoil is about 11 inches thick. The upper part of the subsoil is brown, friable silt loam; and the lower part is dark brown, firm silty clay loam. The substratum, to a depth of about 60 inches, is yellowish brown and brown gravelly loam. In some areas this soil is not eroded. In places, there are dolomite fragments throughout the soil.

Included in mapping are small areas of well drained Mendota soils. Mendota soils and the Markesan soil are

in similar positions on the landscape, but Mendota soils are thicker over the underlying glacial till than the Markesan soil. Also included are small areas of severely eroded Markesan soils that have a silty clay loam surface layer.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and puddle if tilled when too wet. Root development is somewhat limited below a depth of about 12 to 24 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is not naturally forested; therefore, it generally is not managed for woodland.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient stability to support vehicular traffic or foundations of buildings, but this limitation can be overcome by strengthening or replacing the soil with suitable base material. Adding suitable base material can help prevent damage to local roads and streets from frost action. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass not assigned.

MoA—Mayville silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on concave foot slopes of ground moraines and drumlins and on the crests of wide drumlins. The areas are long and narrow and range from 3 to 30 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The subsoil is about 25 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is brown, firm silty clay loam and dark brown, firm clay loam; and the lower part is brown, friable gravelly loam. The substratum, to a depth of about 60 inches, is brown gravelly loam. In many places, the underlying glacial till contains a large amount of pebbles and cobblestones. In places, the surface layer is darker than in the typical profile. In other places, the depth to glacial till is less than 30 inches.

Included in mapping are small areas of well drained Dodge soils, well drained and moderately well drained Juneau soils, and somewhat poorly drained Lamartine soils. Dodge and Lamartine soils and the Mayville soil formed in similar material. Dodge soils and the Mayville soil are in similar positions on the landscape, and Juneau and Lamartine soils are lower on the landscape. Juneau soils are on flood plains and have a silty substratum. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development for some crops is limited by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor to fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keeps the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when this soil is wet, or the use of heavy machinery can cause surface compaction and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of wetness. The suitability for septic tank absorption fields can be improved by building a filtering mound or by providing drainage to lower the water table. This soil has fair suitability for most forms of building site development. If used for this purpose, the soil should be drained. This soil does not have sufficient strength and

stability to support vehicular traffic or buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. This can also help reduce the damage to local roads and streets from frost action.

Capability class I; woodland suitability subclass 2o.

MoB—Mayville silt loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on concave foot slopes of ground moraines and drumlins and on the crests of wide drumlins. Areas of this map unit are long and narrow and range from 3 to 15 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The subsoil is about 25 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is brown, firm silty clay loam and dark brown, firm clay loam; and the lower part is brown, mottled, friable gravelly loam. The substratum, to a depth of about 60 inches, is brown gravelly loam. In places, the depth to glacial till is less than 30 inches.

Included in mapping are small areas of well drained Dodge soils, well drained and moderately well drained Juneau soils, somewhat poorly drained Lamartine soils, and well drained McHenry, Miami, and Theresa soils. Dodge and Lamartine soils and the Mayville soil formed in similar material. Dodge, McHenry, Miami, and Theresa soils and the Mayville soil are in similar positions on the landscape. Juneau and Lamartine soils are lower on the landscape than the Mayville soil. Juneau soils are on flood plains and have a silty substratum. McHenry, Miami, and Theresa soils have a thinner silty mantle than the Mayville soil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. The surface layer is friable and is easily tilled within a wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development of some crops is limited by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, or trees. The potential is fair to poor for most engineering uses.

This soil is suited to corn, soybeans, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of wetness. The suitability for septic tank absorption fields can be improved by building a filtering mound or by providing drainage to lower the water table. This soil has fair suitability for most forms of building site development. If used for this purpose, the soil should be drained. This soil does not have sufficient strength and stability to support vehicular traffic or buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. This can also help reduce damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass 2o.

MoC—Mayville silt loam, 6 to 12 percent slopes. This sloping, moderately well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The subsoil is about 25 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is brown, firm silty clay loam and dark brown, firm clay loam; and the lower part is brown, mottled, friable gravelly loam. The substratum, to a depth of about 60 inches, is brown gravelly loam. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil. In some places, the depth to glacial till is less than 30 inches.

Included in mapping are small areas of well drained Dodge, Miami, and Theresa soils. These included soils and the Mayville soil are in similar positions on the landscape. Dodge soils and the Mayville soil formed in similar material. Miami and Theresa soils have a thinner silty layer than the Mayville soil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. The surface layer is friable and is easily tilled within a wide range in moisture content. It does,

however, have a tendency to crust after heavy rain. Root development of some crops is limited by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor to fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of wetness and slope. The suitability for septic tank absorption fields can be improved by building a filtering mound or by providing drainage to lower the water table. This soil has fair suitability for most forms of building site development. If used for this purpose, the soil should be drained. This soil does not have sufficient strength and stability to support vehicular traffic or buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. This can also help reduce the damage to local roads and streets from frost action. Because of the steepness of the slope, land shaping may be necessary.

Capability subclass IIIe; woodland suitability subclass 2o.

MrB—McHenry silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex foot slopes of drumlins and ground moraines. The areas are long and narrow and range from 5 to 30 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 9 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 25 inches thick. The upper part of the subsoil is brown, firm silty clay loam, and the lower part is dark brown, firm clay loam and sandy clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown gravelly sandy loam. In places, the surface layer is loam or sandy loam. In some places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained and moderately well drained St. Charles soils. St. Charles soils and the McHenry soil are in similar positions on the landscape, but St. Charles soils have a thicker silty layer. These included soils make up about 5 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is also good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material can help to improve soil fertility and keep the soil in good condition.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to building site development if proper design and installation are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Adding suitable base material can help prevent damage to local roads and streets from frost action. This soil is poorly suited to most sanitary facilities; seepage may be a problem. Sealing the soil material can reduce seepage. The soil is well suited to septic tank absorption fields.

Capability subclass IIe; woodland suitability subclass 2o.

MrC2—McHenry silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are long and narrow and range from 5 to 15 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 6 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 26 inches thick. The upper part of the subsoil is brown, firm silty clay loam; and the lower part is dark reddish brown, firm sandy clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown gravelly sandy loam. In places, the surface layer is loam or sandy loam. In some places, this soil is not eroded.

Included in mapping are small areas of McHenry soils that are severely eroded. Also included are well drained and moderately well drained St. Charles soils. St. Charles soils and the McHenry soil are in similar positions on the landscape, but the St. Charles soils have a thicker silty layer. These included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled at the proper moisture content. Some subsoil material is mixed in the plow layer, so this soil is somewhat difficult to till when wet. It has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, however, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities. There is a hazard of pollution ground water because of the moderate or moderately rapid permeability of the substratum. Sealing the soil material can reduce seepage. This soil is suited to septic tank absorption fields. It also is suited to building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Adding suitable base material can help prevent damage to local roads and streets from frost action. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

MrD2—McHenry silt loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are long and narrow and range from 3 to 15 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 6 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 26 inches thick. The upper part of the subsoil is brown, firm silty clay loam; the middle part is dark brown, firm clay loam; and the lower part is dark reddish brown, firm sandy clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown gravelly sandy loam. In places, the surface layer is loam or sandy loam. In some places, this soil is not eroded.

Included in mapping are small areas of McHenry soils that are severely eroded. These inclusions make up about 5 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is fair for row crops, hay, and pasture and good for trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Soil-related problems of forest management are the steepness of slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting can expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to sanitary facilities and building site development because of the steepness of slope. This limitation can be avoided or overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. This soil also does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with a suitable base material. There is a hazard of pollution of ground water from some forms of onsite waste disposal because of the moderately rapid permeability of the substratum. Sealing the soil material can reduce seepage.

Capability subclass IVe; woodland suitability subclass 2r.

MsB—Mendota silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex side slopes of ground moraines. Areas of this map unit are irregular in shape and range from 10 to 50 acres in size.

Typically, the upper part of the surface layer is very dark brown silt loam about 8 inches thick, and the lower part is dark brown silt loam about 2 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam; the middle part is dark brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown and yellowish brown gravelly loam. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained and moderately well drained Plano soils. These included soils and the Mendota soil are in similar positions on the landscape. Plano soils have a thicker layer of silty material and fewer dolomite fragments in the underlying glacial till than the Mendota soil.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. Root development is somewhat limited below a depth of about 20 to 40 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is fair to good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keeps the soil in good condition.

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

This soil is not naturally forested; therefore, it generally is not managed for woodland.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass not assigned.

MsC2—Mendota silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of ground moraines and drumlins. Areas of this map unit are irregular in shape and range from 5 to 40 acres in size.

Typically, the upper part of the surface layer is very dark brown silt loam about 8 inches thick, and the lower part is dark brown silt loam about 2 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam; the middle part is dark brown, firm silty clay loam; and the lower part is dark brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown and yellowish brown gravelly loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Markesan soils and well drained and moderately well drained Plano soils. Markesan and Plano soils are in positions on the landscape similar to those of the Mendota soil. Markesan soils are shallower to underlying glacial till. Plano soils have a thicker silty layer and fewer dolomite fragments in the underlying till than the Mendota soil. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The

available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and puddle if tilled when too wet. Root development is somewhat limited below a depth of about 20 to 40 inches by the high lime content of the substratum.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a moderate hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is not naturally forested; therefore, it generally is not managed for woodland.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass not assigned.

MyB—Miami silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex crests and upper side slopes of drumlins and ground moraines (fig. 7). Areas of this map unit are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part of the subsoil is brown, firm clay loam; the middle part is brown, firm sandy clay loam; and the lower part is dark yellowish brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In places, the surface layer is loam. In some places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained and moderately well drained St. Charles soils. These included soils and the Miami soil are in similar positions on the landscape, but St. Charles soils have a thicker layer of silty material. Also included are some areas of Miami soils that are moderately well drained and some areas of Miami soils that have stones on the surface and in the subsoil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is also good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. The moderately slow permeability in some areas is a limitation for septic tank absorption fields, but it can be overcome by enlarging the absorption area or by building a filtering mound.

Capability subclass IIe; woodland suitability subclass 2o.

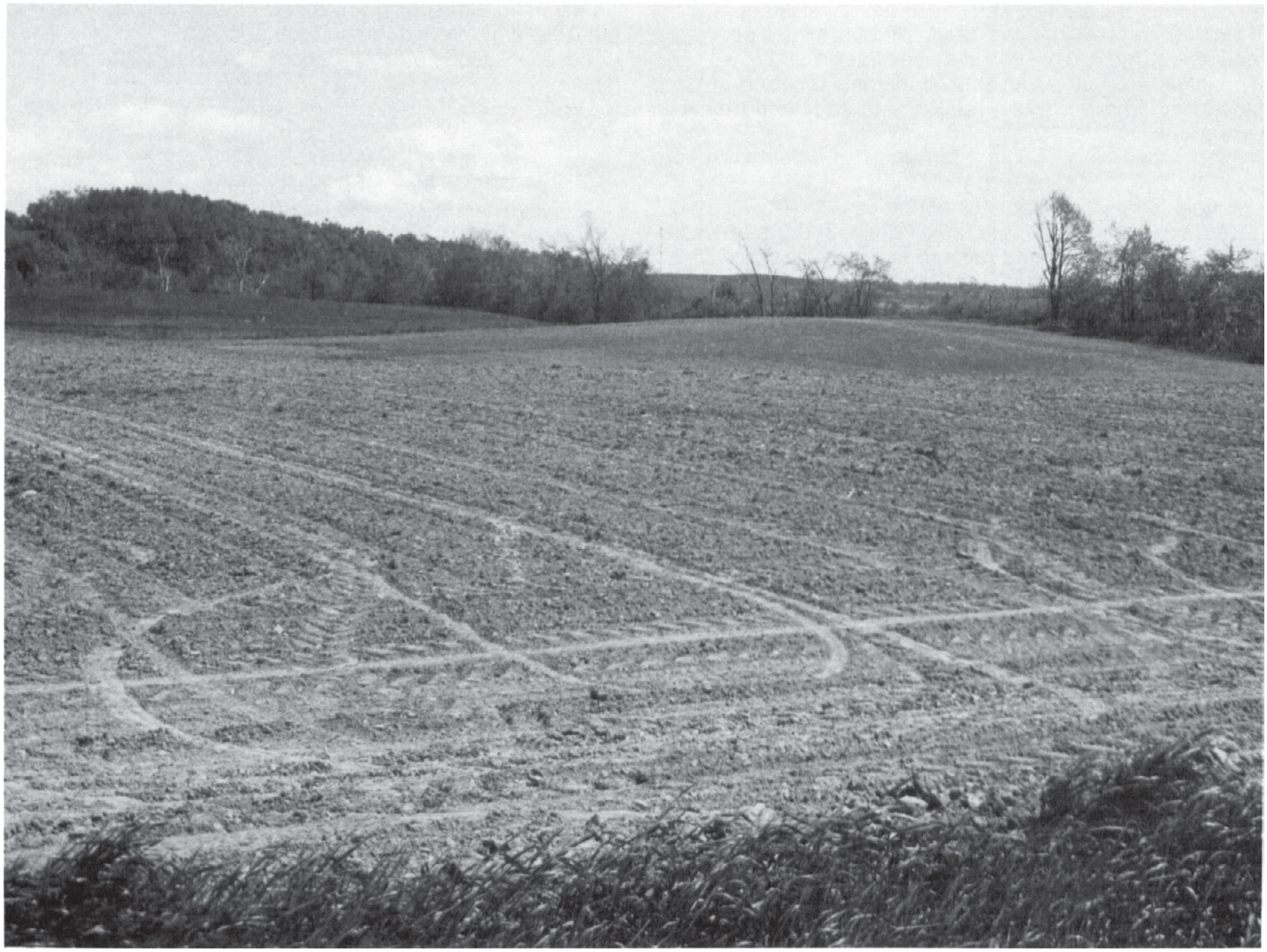

Figure 7.—The soil in the foreground is Miami silt loam, 2 to 6 percent slopes. The soil in the wooded area is Miami silt loam, 6 to 12 percent slopes, eroded.

MyC2—Miami silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 18 inches thick. The upper part of the subsoil is brown, firm clay loam; the middle part is brown, firm sandy clay loam; and the lower part is dark yellowish brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In places, the surface layer is loam. In some areas this soil is not eroded.

Included in mapping are small areas of Miami soils that are severely eroded and small areas of well drained and moderately well drained St. Charles soils. These included soils and the major soil are in similar positions on the landscape. The included soils have a thicker layer of silty material than the Miami soil. Also included are some areas of Miami soils that are moderately well drained and some areas of Miami soils that have stones on the surface and in the subsoil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is

moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a moderate hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. The moderately slow permeability in some areas is a limitation for septic tank absorption fields, but it can be overcome by enlarging the absorption area or by building a filtering mound. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and for septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

MyD2—Miami silt loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is on convex side slopes of drumlins and moraine ridges. Areas of this map unit are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is dark brown, firm clay loam; the middle part is brown, firm sandy clay loam; and the lower part is dark yellowish brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In places, the surface layer is loam.

Included in mapping are small areas of Miami soils that have stones on the surface and in the subsoil. These inclusions make up about 5 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are used for hay and as pasture, and some areas are used for trees. A few areas are used for row crops. The potential is poor for row crops and fair for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is poorly suited to corn and small grain. It is suited to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Soil-related problems in forest management are steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting can expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. This soil also does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with suitable base material.

Capability subclass IVe; woodland suitability subclass 2r.

MzD3—Miami soils, 12 to 18 percent slopes, severely eroded. These moderately steep, well drained soils are on convex side slopes of drumlins and moraines. The original surface layer has been entirely removed by erosion. In places, most of the upper part of the subsoil has been lost. Areas of this map unit are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is brown, firm clay loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is brown, firm sandy clay loam; and the lower part is dark yellowish brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In places, the surface layer is sandy clay loam or loam.

Included in mapping are small areas of eroded Miami soils that have a loam surface layer. These inclusions make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through these soils. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is medium. The organic matter content of the plow layer is low. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is firm and can be tilled only within a narrow range in moisture content without puddling and clods forming.

Most areas of these soils are used as pasture, and some areas are used for hay. The potential is poor for row crops and fair for hay, pasture, and trees. The potential is poor for most engineering uses.

These soils are not suited to corn but can be used for grasses and legumes for hay and pasture. If they are used as pasture, overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

These soils are suited to commercial wood production. Soil-related problems in forest management are steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting can expose sufficient mineral soil to allow adequate regeneration.

These soils are poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. These soils also do not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with a suitable base material.

Capability subclass VIe; woodland suitability subclass 2r.

MzE3—Miami soils, 18 to 30 percent slopes, severely eroded. These steep, well drained soils are on convex side slopes of drumlins and moraines. The original surface layer has been entirely removed by erosion. In places, most of the upper part of the subsoil has been lost. Areas of this map unit are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is brown, firm clay loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part of the subsoil is brown, firm sandy clay loam; the lower part is dark yellowish brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In places, the surface layer is sandy clay loam or loam.

Included in mapping are small areas of eroded Miami soils that have a loamy surface layer. These inclusions make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through these soils. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is firm and can be tilled only within a narrow range in moisture content without puddling and clods forming.

Most areas of these soils are used as pasture, and some areas are used for hay. The potential is poor for row crops and fair for hay, pasture, and trees. The potential is poor for most engineering uses.

These soils are not suited to corn but are suited to legumes for hay and pasture. If they are used as pasture, overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

These soils are suited to commercial wood production. Soil-related problems in forest management are steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting operations can expose sufficient mineral soil to allow adequate regeneration.

These soils are poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be overcome

by using included areas of lesser slope or by land shaping. Construction of local roads and streets generally requires extensive cutting and filling. These soils also do not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with suitable base material.

Capability subclass VIIe; woodland suitability subclass 2r.

NeB—Neda silt loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on concave foot slopes of drumlins, ground moraines, and terraces. Areas of this map unit are irregular in shape and range from 5 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 grayish brown silt loam about 4 inches thick. The subsoil is about 14 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the middle part is dark brown, mottled, firm shaly clay loam; and the lower part is dark brown, mottled, firm shaly loam. The substratum, to a depth of about 60 inches, is pale brown and light gray shaly loam. In places, there are stones and cobblestones on the surface.

Included in mapping are small areas of well drained and moderately well drained Juneau soils and moderately well drained Neda Variant soils. Juneau and Neda Variant soils and the Neda soil are in similar positions on the landscape. Juneau soils are also on flood plains and have a silty substratum. Neda Variant soils are underlain by shale bedrock. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth below 3 feet for several months during wet seasons. The surface layer is friable and easily tilled within a wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development of some crops is limited by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and fair for trees. The potential is fair to good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Seedling survival rates can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of wetness. The suitability for septic tank absorption fields can be improved by building a filtering mound or by providing drainage to lower the water table. This soil is fairly suited to most forms of building site development. If used for this purpose, the soil should be drained. This soil does not have sufficient strength and stability to support vehicular traffic or buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material.

Capability subclass IIe; woodland suitability subclass 2c.

NeC2—Neda silt loam, 6 to 12 percent slopes, eroded. This sloping, moderately well drained soil is on convex side slopes of ground moraines and drumlins. Areas of this map unit are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the middle part is dark brown, mottled, firm shaly clay loam; and the lower part is dark brown, mottled, firm shaly loam. The substratum, to a depth of about 60 inches, is pale brown and light gray shaly loam. In places, there are stones and cobblestones on the surface. In some areas this soil is not eroded.

Included in mapping are small areas of moderately well drained Neda Variant soils. Neda Variant soils and the major soil are in similar positions on the landscape, but the Neda Variant soils are underlain by shale bedrock. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth below 3 feet for several months during wet seasons. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development of some crops is limited by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a moderate hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Seedling survival rates can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of wetness and slope. The suitability for septic tank absorption fields can be improved by building a filtering mound or by providing drainage to lower the water table. This soil is fairly suited to most forms of building site development. If used for this purpose, the soil should be drained. This soil does not have sufficient strength and stability to support vehicular traffic or buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Because of steepness of the slope, land shaping may be necessary.

Capability subclass IIIe; woodland suitability subclass 2c.

NeD2—Neda silt loam, 12 to 18 percent slopes, eroded. This moderately steep, moderately well drained soil is on convex side slopes of drumlins and moraines. Areas of this map unit are irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the middle part is dark brown, mottled, firm shaly clay loam; and the lower part is dark brown, mottled, firm shaly loam. The substratum, to a depth of about 60 inches, is pale brown and light gray shaly loam. In places, there are stones and cobblestones on the surface. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Hochheim soils. Hochheim soils and the Neda soil are in similar positions on the landscape, but the Hochheim soils are underlain by glacial till that is derived partly from dolomite. Some areas of the Neda soil contain outcrops of shale. Also included are small areas of Neda soils that have slopes of more than 18 percent. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth below 3 feet for several months during wet seasons. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development of some crops is limited by the water table.

Most areas of this soil are used as pasture or for hay. A few areas are used for row crops. The potential is fair for row crops and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Erosion can be controlled by planting trees on the contour and by carefully locating skid roads during harvest. These practices also simplify the use of equipment. The rate of survival of planted trees can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of slope and wetness. It is poorly suited to building site development because of slope. The slope limitation can be avoided or overcome by using included areas of lesser slope or by shaping the site. Wetness can be controlled by artificial drainage. The construction of local roads and streets generally requires extensive cutting and filling. This soil does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with suitable base material.

Capability subclass IVe; woodland suitability subclass 2c.

NeE2—Neda silt loam, 18 to 30 percent slopes, eroded. This steep, moderately well drained soil is on convex side slopes of drumlins and moraines. The areas

are long and narrow and range from 3 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 13 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the lower part is dark brown, mottled, firm shaly clay loam. The substratum, to a depth of about 60 inches, is pale brown and light gray shaly loam. In some areas this soil is not eroded. In places, there are stones and cobblestones on the surface.

Included in mapping are small areas of well drained Hochheim soils. Hochheim soils and the Neda soil are in similar positions on the landscape, but the Hochheim soils are underlain by glacial till that is derived partly from dolomite. Some areas of the Neda soil contain outcrops of shale. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth below 3 feet for several months during wet seasons. The surface layer is friable and easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development of some crops is limited by the water table.

Most areas of this soil are used as pasture or woodland. The potential is poor for row crops and fair for hay, pasture, and trees. The potential is poor for most engineering uses.

If this soil is used as pasture and for hay, overgrazing, grazing when the soil is too wet, or the use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Erosion can be controlled by planting trees on the contour and by carefully locating skid roads during harvest. These practices also simplify the use of equipment. The rate of survival of planted trees can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities because of slope and wetness. It is poorly suited to building site development because of slope. The slope limitation can be avoid or overcome by using included areas of lesser slope or by shaping the site. Wetness can be controlled by artificial drainage. The construction of local roads and streets generally requires extensive cutting and filling. This soil does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with suitable base material.

Capability subclass VIe; woodland suitability subclass 2c.

NvB—Neda Variant silt loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on concave foot slopes of ground moraines, drumlins, and terraces that are underlain by shale bedrock at a depth of 20 to 36 inches. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the upper part of the surface layer is dark gray silt loam about 9 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is brown, very firm silty clay about 9 inches thick. The substratum, to a depth of 60 inches, is stratified grayish brown silt loam and very dark gray silty clay in the upper 4 inches and grayish brown shale in the lower part. In places, there are cobblestones, stones, and boulders on the surface.

Included in mapping are small areas of Neda Variant soils that are 10 to 20 inches thick over shale bedrock and Neda Variant soils that are somewhat poorly drained. Also included are well drained Hochheim soils and moderately well drained Neda soils that are in similar positions on the landscape as the Neda Variant soil. Hochheim soils are underlain by glacial till that is derived partly from dolomite. Neda soils are underlain by shaly glacial drift. The included soils make up about 15 percent of the map unit.

Water and air move at a slow rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is high in the subsoil and moderate in the upper part of the substratum. This soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. The surface layer is friable and is easily tilled within a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is limited to a depth of 20 to 36 inches by the shale bedrock.

Most areas of this soil are farmed. The potential is fair for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and

restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. The seedling survival rate can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities and to building site development. The slow permeability is a limitation to the use of this soil as septic tank absorption fields, but it can be offset by enlarging the absorption area or by building a filtering mound. This soil does not have sufficient strength and stability to support vehicular traffic, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass 3c.

NvC2—Neda Variant silt loam, 6 to 18 percent slopes, eroded. This sloping and moderately steep, moderately well drained soil is on convex side slopes of ground moraines and drumlins that are underlain by shale bedrock at a depth of 20 to 36 inches. Areas of this map unit are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil is brown, very firm silty clay about 8 inches thick. The substratum, to a depth of about 60 inches, is stratified grayish brown silt loam and very dark gray silty clay in the upper 4 inches and grayish brown shale in the lower part. In some areas this soil is not eroded. In places, there are cobblestones, stones, and boulders on the surface.

Included in mapping are small areas of well drained Hochheim soils and moderately well drained Neda soils and some areas of Neda Variant soils that are 10 to 20 inches thick over shale bedrock. Hochheim and Neda soils and the major soil are in similar positions on the landscape. Hochheim soils are underlain by glacial till that derived partly from dolomite, and Neda soils are underlain by shaly glacial drift. The included soils make up about 15 percent of the map unit.

Water and air move at a slow rate through this soil. Surface runoff in cultivated areas is medium or rapid. The available water capacity is moderate, and natural fertility is medium. The shrink-swell potential is high in the subsoil and moderate in the upper part of the substratum. This soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. The surface layer is friable and easily tilled at the proper moisture content. This soil is difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet. Root development is limited to a depth of 20 to 36 inches by the shale bedrock.

Most areas of this soil are farmed. The potential is fair for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material can help to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. The seedling survival rate can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to most sanitary facilities and to building site development. The slow permeability is a limitation to the use of this soil as septic tank absorption fields, but it can be offset by enlarging the absorption area or by building a filtering mound. This soil does not have sufficient strength and stability to support vehicular traffic, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Adding suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIIe; woodland suitability subclass 3c.

NxA—Nenno silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on concave foot slopes of ground moraines and on convex crests of wide drumlins. The areas on foot slopes are occasionally subject to brief periods of flooding. Areas of this map unit are long and narrow and range from 5 to 15 acres in size.

Typically, the upper part of the surface layer is very dark grayish brown silt loam about 8 inches thick, and the lower part is dark grayish brown silt loam about 2 inches thick. The subsoil is about 11 inches thick. The upper part of the subsoil is dark brown, firm clay loam; the lower part is brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled sandy loam. In places, the substratum is clay loam.

Included in mapping are small areas of well drained Hochheim soils, well drained and moderately well drained Juneau soils, somewhat poorly drained

Lamartine soils, and poorly drained Pella soils. Hochheim soils and the Nenno soil formed in similar material and are in similar positions on the landscape. Juneau and Lamartine soils and the Nenno soil are in similar positions on the landscape. Juneau soils are also on flood plains and have a silty substratum. Pella soils are in depressions below the Nenno soil. Lamartine soils have a thicker silty mantle than the Nenno soil. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material can help to keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil is also poorly suited to building site development. If used for this purpose, the soil should be drained, and diversions should be used to protect the site from flooding. Installing a drainage system and replacing the subsoil with suitable base material help to protect roads and streets from damage caused by frost action.

Capability subclass IIw; woodland suitability subclass 2o.

NxB—Nenno silt loam, 2 to 6 percent slopes. This gently sloping, somewhat poorly drained soil is on concave foot slopes of drumlins and ground moraines. It is occasionally subject to brief periods of flooding. Areas of this map unit are long and narrow and range from 5 to 20 acres in size.

Typically, the upper part of the surface layer is very dark grayish brown silt loam about 8 inches thick, and the lower part is dark grayish brown silt loam about 2 inches thick. The subsoil is about 11 inches thick. The upper part of the subsoil is dark brown, firm clay loam; and the lower part is brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled sandy loam. In places, the substratum is clay loam.

Included in mapping are small areas of well drained Hochheim soils and well drained and moderately well drained Juneau soils. Hochheim soils and the Nenno soil are in similar positions on the landscape. Juneau soils and the Nenno soil are in similar positions on the landscape, but Juneau soils are also on flood plains. Juneau soils have a silty substratum. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 1 to 3 feet for several months during wet seasons. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted somewhat by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways can help prevent excessive soil loss. If slopes are long and smooth, terracing or contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities because of the high water table. The suitability for septic tank absorption fields can be improved by building a filtering mound. This soil is also poorly suited to building site development. If used for this purpose, the soil should be

drained, and diversions should be used to protect the site from flooding. Installing a drainage system and replacing the subsoil with suitable base material is needed to protect local roads and streets from damage caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

Ot—Otter silt loam. This nearly level, poorly drained soil is on stream terraces and flood plains. It is frequently subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size. Slopes are 0 to 2 percent.

Typically, the surface layer is black silt loam about 5 inches thick. The subsurface layer is very dark gray and black silt loam about 31 inches thick. The substratum, to a depth of about 60 inches, is dark gray silt loam.

Included in mapping are small areas of very poorly drained Adrian Variant soils, poorly drained Pella soils, and well drained to somewhat poorly drained Udifluvents. Adrian Variant soils and Pella soils are in depressions. Adrian Variant soils have a 16- to 51-inch-thick organic layer over stratified fine sand and silt. Pella soils are underlain by glacial drift. Udifluvents are silty and loamy soils on flood plains. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is low. This soil is saturated to a depth of 2 feet for several months during wet seasons. The surface layer is friable and is easily tilled within a fairly wide range in moisture content. Root development is restricted by the high water table.

Most areas of this soil are used for permanent pasture. If this soil is drained, the potential is good for row crops, hay, and pasture and fair for trees. The potential is poor for most engineering uses.

If this soil is drained and protected from damaging overflow, it is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to keep this soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil and the pasture plants in good condition.

This soil is poorly suited to woodland use. Slow growth and poor form make trees barely merchantable. Soil wetness generally necessitates planting by hand or machine on prepared ridges when natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid seedling mortality. Harvest is frequently limited to periods when the soil is frozen. Harvesting by clearcutting or group selection can help reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass 4w.

Pa—Palms muck. This nearly level, very poorly drained soil is on glacial lake plains and in depressions on till plains and moraines. It is frequently subject to long periods of flooding. Areas of this map unit are irregular in shape and range from 5 to 70 acres in size. Slopes are 0 to 2 percent.

Typically, the organic layer is black and dark reddish brown muck about 26 inches thick. The substratum, to a depth of about 60 inches, is light gray silty clay loam. In places, there are thin layers of coprogenous earth or marl in the lower part of the profile.

Included in mapping are small areas of very poorly drained Houghton soils. Houghton soils and the Palms soil are in similar positions on the landscape, but Houghton soils formed in organic layers that are more than 51 inches thick. Houghton soils make up about 15 percent of the map unit.

Water and air move at a moderately rapid rate through the organic part of this soil and at a moderate or moderately slow rate through the underlying silty clay loam. Surface runoff in cultivated areas is slow or ponded. The available water capacity is very high, and natural fertility is low. The shrink-swell potential is moderate in the substratum. This soil is saturated to a depth of 1 foot for many months during wet seasons. The organic layer is friable and is easily tilled within a wide range in moisture content. Root development is restricted by the water table.

Undrained areas of this soil are used mainly as wildlife habitat or for marsh hay. Drained areas are used for corn and canning crops. The potential is good for these crops and fair for trees. The potential is poor for most engineering uses.

If this soil is drained and cultivated, soil blowing and subsidence are problems. Windbreaks and cover crops reduce soil blowing, and controlled drainage reduces the rate of subsidence.

This soil is suited to commercial wood production. Soil wetness and the high water table during tree planting season limit reforestation to natural regeneration. Harvesting with heavy equipment is limited to periods when the soil is frozen. Harvesting by clearcutting or area selection prevents serious windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass 3w.

Ph—Pella silty clay loam. This nearly level, poorly drained soil is in depressions between drumlins and on glacial lake plains. It is occasionally subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 3 to 200 acres in size. Slopes are 0 to 2 percent.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is very dark gray silty clay loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part of the subsoil is olive gray, firm silty clay loam; the lower part is grayish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown gravelly loam. In places, the surface layer is silt loam or muck. In some places, there are thin layers of sand or muck in the subsoil and substratum.

Included in mapping are small areas of poorly drained Ackmore soils on flood plains and alluvial fans. Unlike Pella soils, Ackmore soils do not overlie glacial drift. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or ponded. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 2 feet for several months during wet seasons. The surface layer is friable, but it must be tilled at the proper moisture content to prevent crusting and puddling. Root development is restricted by the high water table.

Most drained areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is poor for most engineering uses.

If drained, this soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material help to keep this soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil and the pasture plants in good condition.

This soil is poorly suited to woodland use. Slow growth and poor form make trees barely merchantable. Because of soil wetness, planting by hand or machine on prepared ridges generally is necessary if natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcutting or area selection can help reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass 4w.

Pk—Pella Variant silt loam. This nearly level, poorly drained soil is in depressions between drumlins and on ground moraines that are underlain by dolomite bedrock at a depth of 20 to 40 inches (fig. 8). It is occasionally subject to brief periods of flooding. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is black silt loam about 11 inches thick. The subsurface layer is very dark gray silty clay loam about 4 inches thick. The subsoil is olive gray, mottled, firm silty clay loam about 13 inches thick. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock. In places, the subsoil formed in glacial till, is gravelly, and contains stones.

Included in mapping are small areas of poorly drained Pella soils and areas of Pella Variant soils that have a silty clay loam surface layer. Pella soils and the major soil are in similar positions on the landscape, but the Pella soils are underlain by glacial drift. The included soils make up about 10 percent of the map unit.

Water and air move at a moderately slow rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is moderate, and natural fertility is high. The shrink-swell potential is moderate. This soil is saturated to a depth of 1 foot for several months during wet seasons. The surface layer is friable and is easily tilled within a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted by the water table.

Most drained areas of this soil are farmed. Undrained areas are generally used as pasture. If this soil is drained, the potential is good for row crops. The potential is good for hay and pasture and poor for trees. The potential is poor for most engineering uses.

If drained, this soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

If this soil is used as pasture or for hay, overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. Excessive use of machinery should be avoided if this soil is used for hay. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is not naturally forested; therefore, it generally is not managed for woodland.

Figure 8.—A dolomite quarry in an area of Pella Variant silt loam.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and flooding.

Capability subclass IIw; woodland suitability subclass not assigned.

Pn—Pits. This miscellaneous area is made up of quarries, gravel pits, and old iron mines from which dolomite, sand and gravel, quartzite, or iron have been excavated. The areas are irregular in shape and range from 10 to 40 acres in size.

Dolomite quarries are mainly in the eastern part of the county where dolomite is near the surface. Gravel pits are mainly in areas that are underlain by sand and gravel outwash, but a few are in areas of glacial till. Iron mines are near the village of Iron Ridge. During the last part of the 19th century, high grade ore was removed from these iron mines.

Included in mapping are refuse piles of dolomite fragments, large stones, or soil material pushed from the excavation site. Some pits have been excavated to the depth of the water table and are now filled with water.

Soil material associated with Pits is typically very low in natural fertility and is droughty. Other soil properties are too variable to rate.

This miscellaneous area has poor potential for cultivated crops, pasture, trees, and most engineering uses. The main concern of management is reclaiming an area after excavation is finished. Most areas require land shaping and the addition of suitable topsoil to support a vegetative cover.

Capability subclass not assigned; woodland suitability subclass not assigned.

PsA—Plano silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is in concave areas on ground moraines. The areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray silt loam about 12 inches thick. The subsurface layer is dark brown silt loam about 6 inches thick. The subsoil extends below a depth of 60 inches. The upper part of the subsoil is brown, friable silt loam; the middle part is brown and dark brown, firm silty clay loam; and the lower part is brown, friable silt loam and dark brown, friable loam. In places, the soil is silty to a depth of more than 60 inches.

Included in mapping are small areas of moderately well drained Plano soils, somewhat poorly drained Elburn soils, and well drained Mendota soils. Elburn soils and the Plano soil formed in similar material, but Elburn soils are below the Plano soil on the landscape. Elburn soils are in depressions and on foot slopes of drumlins. Mendota soils and the Plano soil are in similar positions on the landscape, but the Mendota soils are thinner over glacial till, which contains more dolomite fragments than the till under the Plano soil. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled within a fairly wide range in moisture content.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or using heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is not naturally forested; therefore, it generally is not managed for woodland.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Adding suitable base material can help prevent frost action damage to local roads and streets.

Capability class I; woodland suitability subclass not assigned.

PsB—Plano silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in concave areas on ground moraines and on foot slopes of drumlins. Areas of this map unit are irregular in shape and range from 5 to 180 acres in size.

Typically, the surface layer is very dark gray silt loam about 12 inches thick. The subsurface layer is dark brown silt loam about 6 inches thick. The subsoil extends below a depth of 60 inches. The upper part of the subsoil is brown, friable silt loam; the middle part is brown and dark brown, firm silty clay loam; and the lower part is brown, friable silt loam and dark brown, friable loam.

Included in mapping are small areas of somewhat poorly drained Elburn soils and well drained Mendota soils. Elburn soils and the Plano soil formed in similar material, but Elburn soils are below the Plano soil on the landscape. Elburn soils are in depressions and on foot slopes of drumlins. Mendota soils and the Plano soil are in similar positions on the landscape, but the Mendota soils are thinner over glacial till, which has more dolomite fragments than the till under the Plano soil. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled within a fairly wide range in moisture content.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is fair for most engineering uses.

This soil is well suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material can help keep the soil in good condition.

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

This soil is not naturally forested; therefore, it generally is not managed for woodland.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent frost action damage to local roads and streets.

Capability subclass IIe; woodland suitability subclass not assigned.

PtA—Plano silt loam, moderately well drained, 0 to 3 percent slopes. This nearly level and gently sloping,

moderately well drained soil is in concave areas on ground moraines. Areas of this map unit are irregular in shape and range from 10 to 90 acres in size.

Typically, the surface layer is very dark brown silt loam about 11 inches thick. The subsurface layer is dark brown silt loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part of the subsoil is dark brown, firm silty clay loam; the middle part is brown, mottled, firm silty clay loam; and the lower part is dark brown, mottled, friable loam. The substratum, to a depth of about 60 inches, is dark brown sandy loam.

Included in mapping are small areas of well drained Mendota and Plano soils. Mendota soils are on convex slopes and are thinner over glacial till, which has more dolomite fragments than the till under the Plano soil. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are farmed. The potential is good for row crops, hay, and pasture and poor for trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or using heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is not naturally forested; therefore, it generally is not managed for woodland.

This soil is suited to building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with suitable base material. Suitable base material can also help prevent frost action damage to local roads and streets. Drainage is needed to prevent wetness in basements and shallow excavations during wet seasons. This soil is poorly suited to sanitary facilities because of the seasonal high water table, but this limitation can be overcome by artificial drainage. The suitability for septic tank absorption fields can be improved by building a filtering mound.

Capability class I; woodland suitability subclass not assigned.

PuB—Puchyan loamy fine sand, 2 to 6 percent slopes. This gently sloping, well drained and moderately well drained soil is on convex crests and concave foot slopes of drumlins and moraines. The areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 9 inches thick. The subsurface layer is 14 inches thick. In the upper 4 inches it is yellowish brown loamy fine sand, and below that it is light yellowish brown fine sand. The subsoil is about 19 inches thick. The upper part of the subsoil is dark brown, friable sandy loam; the middle part is dark brown, friable loam; and the lower part is brown, mottled, friable silt loam. The substratum is brown, mottled silt loam in the upper 8 inches, and below that, to a depth of about 60 inches, it is yellowish brown gravelly loam. In places, the surface layer is fine sandy loam.

Included in mapping are small areas of excessively drained Chelsea soils and well drained Sisson soils. Chelsea soils and the Puchyan soil are in similar positions on the landscape, but the Chelsea soils are sandy throughout. Sisson soils are on or adjacent to glacial lake plains and are loamy. Also included are small areas of Puchyan soils that have slopes of more than 6 percent. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is medium. The shrink-swell potential is low. In places, this soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. In many places, the water table is below a depth of 5 feet. The surface layer is very friable and is easily tilled throughout a wide range in moisture content.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material can help to improve fertility and keep the soil in good condition.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

Well drained areas of this soil are suited to most sanitary facilities and to building site development if proper design and installation procedures are used.

Moderately well drained areas of this soil need drainage to prevent wetness in basements and excavations during wet seasons. These areas are poorly suited to sanitary facilities unless a drainage system is installed. The suitability for septic tank absorption fields in moderately well drained areas can be improved by building a filtering mound.

Capability subclass IIIs; woodland suitability subclass 3o.

RcE—Rock outcrop-Channahon complex, 5 to 30 percent slopes. This complex consists of outcrops of dolomite intermingled with areas of gently sloping to steep, well drained Channahon silt loam. The Channahon soil is in convex areas on ground moraines that are underlain by dolomite at a depth of 10 to 20 inches. This complex is in irregularly shaped areas that range from 3 to 30 acres in size. It is about 65 percent Rock outcrop and 30 percent Channahon silt loam.

Included in mapping are small areas of well drained Knowles soils that are in shallow depressions and are more gently sloping than the Channahon soil. Knowles soils are underlain by dolomite bedrock at a depth between 20 and 40 inches. The included soils make up about 5 percent of the complex.

The outcrops of dolomite are bare of vegetation. Plant growth is limited to soil-filled cracks in the dolomite. In places, the outcrops are sandstone or quartzite. Runoff is rapid.

Typically, the upper part of the surface layer of the Channahon soil is very dark brown silt loam about 9 inches thick, and the lower part is very dark grayish brown silt loam about 4 inches thick. The subsoil is dark brown, firm silty clay loam about 5 inches thick. The substratum, to a depth of about 60 inches, is creviced dolomite bedrock.

Water and air move at a moderate rate through the Channahon soil. Surface runoff in cultivated areas is medium or rapid. The available water capacity is low, and natural fertility is medium. Root development is restricted below a depth of 10 to 20 inches by dolomite bedrock. In places, however, roots grow into soil-filled crevices in the dolomite.

The Channahon soil is used as woodland or pasture. The potential is poor or very poor for cultivated crops, hay, and pasture and fair for trees. The potential is very poor for most engineering uses.

The Channahon soil is suited to commercial wood production. The survival rate of planted trees during dry seasons can be increased by careful planting of vigorous nursery stock. Harvesting by clearcutting or area selection can help reduce the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This complex is poorly suited to sanitary facilities and building site development because of slope and shallowness to bedrock. Bedrock limits land shaping and excavation for dwellings with basements.

Capability subclass VIe; Channahon part in woodland suitability subclass 3d; Rock outcrop not assigned to a woodland suitability subclass.

RxC2—Rodman-Casco complex, 6 to 12 percent slopes, eroded. This complex consists of sloping, excessively drained and well drained soils in convex areas on eskers, kames, moraines, and outwash terrace escarpments (fig. 9). The areas are irregular in shape and range from 5 to 25 acres in size. This complex is about 50 percent Rodman gravelly loam and 35 percent Casco loam.

Included with these soils in mapping are small areas of well drained Fox soils that are in depressions and are more gently sloping than the Rodman and Casco soils. Fox soils are thicker over sand and gravel than Casco or Rodman soils. Also included are very poorly drained organic soils and poorly drained or somewhat poorly drained mineral soils in depressions. The included soils make up about 15 percent of the complex.

Typically, the surface layer of the Rodman soil is very dark gray gravelly loam about 5 inches thick. The subsoil is dark yellowish brown, friable gravelly loam about 6 inches thick. The substratum, to a depth of about 60 inches, is pale brown sand and gravel.

Typically, the upper part of the surface layer of the Casco soil is dark grayish brown loam about 8 inches thick, and the lower part is brown loam about 3 inches thick. The subsoil is dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown sand and gravel.

Water and air move through the Casco soil at a moderate rate in the subsoil and at a very rapid rate in the substratum. They move through the Rodman soil at a very rapid rate. Surface runoff from cultivated areas is medium. The available water capacity is very low in the Rodman soil and moderate in the Casco soil. Natural fertility is low in the Rodman soil and medium in the Casco soil. The shrink-swell potential of the Casco soil is moderate in the subsoil and very low in the substratum. The shrink-swell potential of the Rodman soil is low. Roots of most crops do not develop well in the droughty substratum of these soils.

Most areas of these soils are used as pasture, woodland, or wildlife habitat. The potential is poor for row crops, fair for pasture, and fair to good for trees. These soils have fair potential for most engineering uses.

If these soils are used as pasture, overgrazing or grazing when the soils are too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

The Casco soil is suited to commercial wood production. The seedling survival rate can be increased

Figure 9.—A typical area of Rodman-Casco complex, 6 to 12 percent slopes, eroded, is in the background. The soil in the foreground is Fox silt loam, 2 to 6 percent slopes.

by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

The Rodman soil is poorly suited to commercial wood production because trees grow slowly on this soil and are poorly formed. In dry years, the seedling survival rate is poor. It can be improved to a degree by careful planting and by using vigorous nursery stock.

In most places, the soils making up this complex are poorly suited to sanitary facilities. There is a hazard of pollution of ground water because of the very rapid permeability of the substratum. In most places, these soils are moderately well suited to building site development. Because of the steepness of the slope, land shaping may be necessary in places. On sites for local roads and streets, the subsoil of the Casco soil should be replaced with a suitable base material to prevent problems associated with frost action. The substratum of these soils is a good source of sand and gravel.

Capability subclass VIs; Rodman part in woodland suitability subclass 4f, Casco part in 3s.

RxD2—Rodman-Casco complex, 12 to 30 percent slopes, eroded. This complex consists of moderately steep and steep, excessively drained and well drained soils in convex areas on eskers, kames, moraines, and outwash terrace escarpments. The areas are irregular in shape and range from 5 to 25 acres in size. This complex is about 60 percent Rodman soils and 30 percent Casco soils.

Included in mapping are small areas of Casco and Rodman soils that have slopes of less than 6 percent, poorly drained mineral soils, and very poorly drained organic soils in depressions. These included soils make up about 10 percent of the map unit.

Typically, the surface layer of the Rodman soils is very dark gray gravelly loam about 5 inches thick. The subsoil is dark yellowish brown, friable gravelly loam about 6 inches thick. The substratum, to a depth of about 60 inches, is pale brown sand and gravel.

Typically, the upper part of the surface layer of the Casco soils is dark grayish brown loam about 8 inches thick, and the lower part is brown loam about 3 inches thick. The subsoil is dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown sand and gravel.

Water and air move through the Casco soils at a moderate rate in the subsoil and at a very rapid rate in the substratum. They move through the Rodman soils at a very rapid rate. Surface runoff in cultivated areas is rapid. The available water capacity is very low in the Rodman soils and moderate in the Casco soils. Natural fertility is low in the Rodman soils and medium in the Casco soils. The shrink-swell potential of the Casco soils is moderate in the subsoil and very low in the substratum. The shrink-swell potential of the Rodman soils is low. Roots of most crops do not develop well in the droughty substratum of these soils.

Most areas of this complex remain in woodland and are used as wildlife habitat. Some areas are used for recreation. The potential is very poor for row crops, hay, and pasture and fair to good for trees. The soils have poor potential for most engineering uses.

Casco soils are suited to commercial wood production. Erosion can be controlled by planting trees on the contour and by carefully locating skid roads during harvest. These practices facilitate the use of equipment. The survival rate of planted trees can be increased by careful planting of vigorous nursery stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

Rodman soils are poorly suited to woodland use because tree growth is slow and trees are poorly formed. Erosion can be reduced by planting trees on the contour and by carefully locating skid roads. These practices facilitate the use of equipment. The poor survival rate of planted trees during dry seasons can be offset by careful planting of vigorous nursery stock.

Most areas of this complex are poorly suited to sanitary facilities because of the steepness of slope and the hazard of pollution of ground water due to the very rapid permeability of the substratum. The soils are poorly suited to building site development. Because of the steepness of the slope, land shaping may be necessary in places. The substratum of these soils is a good source of sand and gravel.

Capability subclass VIIs; Rodman part in woodland suitability subclass 4f, Casco part in 3s.

ScA—St. Charles silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is in concave areas on ground moraines and on foot slopes of drumlins. The areas are irregular in shape and range from 10 to 60 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil extends below a depth of 60 inches. The upper part of the subsoil is brown and dark brown, firm silty clay loam; the lower part is dark brown and dark yellowish brown, friable loam. The substratum is brown sandy loam.

Included in mapping are small areas of well drained Dodge soils. Dodge soils and the St. Charles soil are in similar positions on the landscape, but the Dodge soils are thinner over glacial till. Also included are small areas of St. Charles soils that are moderately well drained. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair to good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keeps the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or using heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action.

Capability class I; woodland suitability subclass 2o.

ScB—St. Charles silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on concave foot slopes of drumlins and ground moraines and on convex slopes on crests of drumlins. The areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the

lower part is brown silt loam about 2 inches thick. The subsoil extends below a depth of 60 inches. The upper part of the subsoil is brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, friable loam. Some areas of this soil are eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of moderately well drained St. Charles soils and well drained Dodge, Miami, and Theresa soils. Moderately well drained St. Charles soils are on the lower foot slopes of drumlins. Dodge, Miami, and Theresa soils are in positions on the landscape similar to those of the major soil but are thinner over glacial till. Theresa soils are underlain by glacial till that has a relatively high content of dolomite fragments. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow or medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair to good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways can help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keep the soil in good condition.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage to local roads and streets from frost action.

Capability subclass IIe; woodland suitability subclass 2o.

ScC2—St. Charles silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is about 48 inches thick. The upper part of the subsoil is brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, friable loam. The substratum, to a depth of about 60 inches, is brown sandy loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Dodge, Lomira, McHenry, and Miami soils. These included soils and the St. Charles soil are in similar positions on the landscape, but the included soils have thinner silty layers over glacial till. Lomira soils are underlain by glacial till that contains more dolomite fragments than the till under the St. Charles soil. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. It has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways can help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures

are used. It does not have sufficient strength and stability to support vehicular traffic and foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage from frost action to local roads and streets. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and for septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

SdA—St. Charles silt loam, moderately well drained, 0 to 3 percent slopes. This nearly level and gently sloping soil is on concave foot slopes of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The upper part of the subsurface layer is very dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 6 inches thick. The subsoil is about 29 inches thick. The upper part of the subsoil is brown, mottled, firm silty clay loam; the lower part is brown, mottled, friable silt loam. The substratum, to a depth of about 60 inches, is brown sandy loam.

Included in mapping are small areas of well drained and moderately well drained Juneau soils and poorly drained Pella soils. Juneau soils and the St. Charles soil are in similar positions on the landscape, but Juneau soils are also on flood plains. They are underlain by silty material rather than by glacial till. Pella soils and the St. Charles soil formed in similar material, but Pella soils are in depressions. The included soils make up about 5 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. This soil is saturated to a depth of 3 to 5 feet for several months during wet seasons. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development of some crops is limited by the water table.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material can help to improve fertility and keep the soil in good condition.

If this soil is used as pasture, overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to building site development if proper design and installation procedures are used. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Adding a suitable base material can help prevent damage from frost action to local roads and streets. Drainage is needed to prevent wetness in basements and shallow excavations during wet seasons. This soil is poorly suited to sanitary facilities because of the seasonal high water table, but this limitation can be overcome by drainage. The suitability for septic tank absorption fields can be improved by building a filtering mound.

Capability class I; woodland suitability subclass 2o.

SeA—St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes. This nearly level, well drained soil is on concave outwash plains. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part of the subsoil is brown, firm silty clay loam; the middle part is brown, friable silt loam; and the lower part is brown, friable, gravelly sandy clay loam. The substratum, to a depth of about 60 inches, is pale brown sand and gravel.

Included in mapping are small areas of well drained Fox soils. The Fox soils and the St. Charles soil are in similar positions on the landscape, but the Fox soils are shallower to sand and gravel. These included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for cultivated crops, hay, pasture, and trees. The potential is good also for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material

helps to improve fertility and keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or using heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil and the pasture plants in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to some sanitary facilities and to building site development if proper design and installation procedures are used. There is a hazard of pollution of ground water because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. This soil does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. The substratum is a good source of sand and gravel.

Capability class I; woodland suitability subclass 2o.

SeB—St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes. This gently sloping, well drained soil is in convex areas on outwash plains. The areas are irregular in shape and range from 5 to 15 acres in size.

Typically, the upper part of the surface layer is grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 2 inches thick. The subsoil is about 34 inches thick. The upper part of the subsoil is brown, firm silty clay loam; the middle part is brown, friable silt loam; and the lower part is brown, friable gravelly sandy clay loam. The substratum, to a depth of about 60 inches, is pale brown sand and gravel. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained Fox soils. Fox soils and the St. Charles soil are in similar positions on the landscape, but the Fox soils are shallower to sand and gravel. Fox soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a very rapid rate through the substratum. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair to good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to some sanitary facilities and to building site development if proper design and installation procedures are used. There is a hazard of pollution of ground water because of the very rapid permeability of the substratum. Sealing the soil material can reduce seepage. This soil does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. The substratum is a good source of sand and gravel.

Capability subclass IIe; woodland suitability subclass 2o.

Sk—Saprists and Aquents. These very poorly drained, nearly level soils are in lake basins and on flood plains. They are subject to frequent very long periods of flooding. The areas are irregular in shape and range from 10 to 30 acres in size. Slopes are 0 to 2 percent.

Saprists and Aquents can occur either separately or together in a mapped area. They are too wet or too variable to classify except at the suborder level. Where both soils occur, Saprists make up 50 to 90 percent of the map unit.

Saprists formed in dark colored organic layers that are underlain by loamy, silty, or sandy layers at a depth of 16 to 51 inches or in organic layers that are more than 51 inches thick.

Aquents have a wide range of color and texture but typically are silty, loamy, or sandy to a depth of at least 60 inches. In places, there is a thin organic layer at the surface, or such layers occur throughout the profile.

Included in mapping are small areas of very poorly drained Adrian Variant, Colwood, Granby Variant,

Houghton, and Palms soils. These soils and Saprists and Aquents are in similar positions on the landscape and formed in similar material. The included soils make up about 10 percent of the map unit.

Permeability and the available water capacity are too variable to rate. Natural fertility is low. These soils are saturated to a depth of 1 foot most of the year.

Most areas of these soils are used for recreation and as wildlife habitat. They have very poor potential for row crops, hay, pasture, trees, or engineering uses.

These soils are not suited to farm crops because of wetness and frequent flooding. Because of their low position on the landscape, most areas cannot be drained. These soils are best suited to recreation or as wetland wildlife habitat.

These soils are very poorly suited to building site development and sanitary facilities because of wetness and the hazard of flooding.

Capability subclass VIIIw; woodland suitability subclass not assigned.

Sm—Sebewa silt loam. This nearly level, poorly drained and very poorly drained soil is in depressions on outwash plains and stream terraces. It is subject to frequent brief periods of flooding. The areas are irregular in shape and range from 5 to 15 acres in size. Slopes are 0 to 2 percent.

Typically, the surface layer is very dark brown silt loam about 12 inches thick. The subsoil is about 15 inches thick. The upper part of the subsoil is dark gray, mottled, firm clay loam; and the lower part is grayish brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is pale brown, mottled, medium and coarse sand. In places, the surface layer is loam. In other places, it is muck.

Included in mapping are small areas of well drained Fox soils, moderately well drained Ionia soils, and poorly drained Pella soils. The Fox and Ionia soils and the Sebewa soil formed in similar material. The Fox and Ionia soils are on convex slopes. They are higher on the landscape than the Sebewa soil. The Pella soils are in depressions and are underlain by glacial drift. The included soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through the subsoil and at a rapid rate through the substratum. Surface runoff in cultivated areas is slow or ponded. The available water capacity is moderate, and natural fertility is high. The shrink-swell potential is moderate. This soil is saturated to a depth of 1 foot for many months during wet seasons. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development is restricted by the high water table.

Most drained areas of this soil are farmed. Undrained areas are used as pasture or wildlife habitat or for hay. The potential is good for row crops and hay if the soil is drained. The potential is good for pasture and fair for trees. The potential is poor for most engineering uses.

If drained, this soil is suited to corn, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility and keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, and the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is poorly suited to woodland use. Slow growth and poor form make trees barely merchantable. Soil wetness generally necessitates planting by hand or machine on prepared ridges when natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcutting or area selection reduces the hazard of windthrow. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is poorly suited to sanitary facilities and building site development because of the high water table and the hazard of flooding.

Capability subclass IIw; woodland suitability subclass 4w.

SuA—Sisson fine sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on glacial lake plains and on ground moraines that are adjacent to glacial lake plains. The areas are long and narrow and range from 3 to 15 acres in size.

Typically, the surface layer is dark gray fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is brown, firm loam; and the lower part is brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is pale brown stratified silt and very fine sand. In places, the surface layer is silt loam or loam.

Included in mapping are small areas of somewhat poorly drained Kibbie soils. The Kibbie soils and the Sisson soil formed in similar material, but the Kibbie soils are lower on the landscape. Kibbie soils make up about 10 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is slow. The available water capacity is high, and natural fertility is high. The shrink-swell potential is low. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor to good for most engineering uses.

This soil is suited to corn, soybeans, small grain, and grasses and legumes for hay and pasture. Returning crop residue to the soil or regularly adding other organic material can help to keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or using heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength to support vehicular traffic or foundations of buildings, but this limitation can be overcome by strengthening or replacing the soil with a suitable base material.

Capability class I; woodland suitability subclass 2o.

SuB—Sisson fine sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in concave areas on glacial lake plains and side slopes of ground moraines that are adjacent to glacial lake plains. The areas are long and narrow and range from 3 to 15 acres in size.

Typically, the surface layer is dark gray fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is brown, firm loam; and the lower part is brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is pale brown stratified silt and very fine sand. In places, the surface layer is silt loam or loam. In some places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and material from the subsoil.

Included in mapping are small areas of well drained Dodge soils and somewhat poorly drained Kibbie soils. Dodge soils are on ground moraines and are underlain by glacial till. Kibbie soils and the Sisson soil formed in similar material, but the Kibbie soils are lower on the landscape. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is low. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor to good for engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a slight hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can be used to reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength to support vehicular traffic or foundations of buildings, but this limitation can be overcome by strengthening or replacing the soil with a suitable base material.

Capability subclass IIe; woodland suitability subclass 2o.

SuC2—Sisson fine sandy loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of ground moraines and drumlins that are adjacent to glacial lake plains. The areas are long and narrow and range from 3 to 10 acres in size.

Typically, the surface layer is dark gray fine sandy loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is brown, firm loam; and the lower part is brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is pale brown stratified silt and very fine sand. In places, the surface layer is silt loam or loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Dodge and Miami soils. Dodge and Miami soils are on ground moraines and drumlins and are underlain by glacial till. They make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is low. The surface layer is friable and is easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. It has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor to fair for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil is suited to sanitary facilities and building site development if proper design and installation procedures are used. It does not have sufficient strength to support vehicular traffic or foundations of buildings, but this limitation can be overcome by strengthening or replacing the soil with a suitable base material. Because of steepness of the slope, land shaping may be necessary at sites for buildings and septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

SuD2—Sisson fine sandy loam, 12 to 25 percent slopes, eroded. This moderately steep and steep, well drained soil is on convex side slopes of ground moraines and drumlins that are adjacent to glacial lake plains. The areas are long and narrow and range from 3 to 10 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 22 inches thick. The upper part of the subsoil is brown, friable loam; the middle part is brown, firm loam; and the lower part is brown, friable fine sandy loam. The substratum, to a depth of about 60 inches, is pale brown stratified silt and very fine sand. In places, the surface layer is silt loam or loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Dodge, Miami, and Theresa soils. These soils are on ground moraines and drumlins that are underlain by glacial till. They make up about 15 percent of the map unit.

Water and air move at a moderate rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is low. The surface layer is friable and is easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. It has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is fair for row crops and good for hay, pasture, and trees. The potential is poor for most engineering uses.

This soil is suited to grasses and legumes for hay and pasture and to corn and small grain. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material can help to improve fertility, reduce crusting, and increase water infiltration.

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

This soil is suited to commercial wood production. Soil-related problems in forest management are steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be avoided or overcome by using areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. This soil does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the soil with a suitable base material.

Capability subclass IVe; woodland suitability subclass 2r.

ThB—Theresa silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is in convex areas on the crests and upper side slopes of ground moraines and drumlins (fig. 10). The areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 8 inches thick, and the lower part is brown silt loam about 3 inches thick. The subsoil is about 28 inches thick. The upper part of the

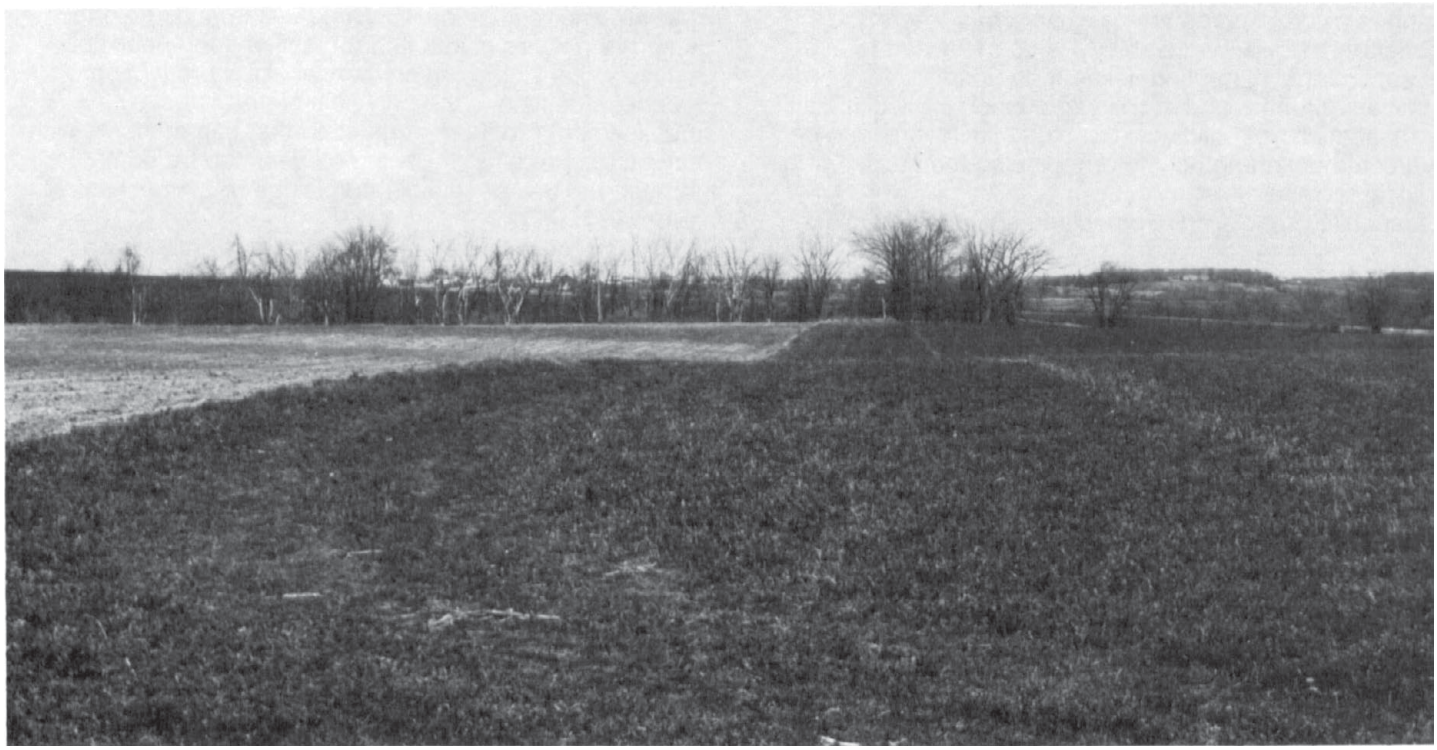

Figure 10.—Typical landscape in an area of Theresa silt loam, 2 to 6 percent slopes.

subsoil is dark yellowish brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is brown, firm clay loam and loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In places, this soil is eroded, and the plow layer is a mixture of material from the original surface layer and dark yellowish brown material from the subsoil.

Included in mapping are small areas of well drained Dodge and Hochheim soils and moderately well drained Mayville soils. These included soils and the Theresa soil are in similar positions on the landscape. Dodge and Mayville soils have thicker silty layers than the Theresa soil. Hochheim soils are thinner over the underlying glacial till. Also included are some areas of Theresa soils that are mottled in the lower part of the subsoil and in the substratum. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and in the substratum. The surface layer is friable and is easily tilled throughout a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is fair to good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. If slopes are long and smooth enough, terracing and contour farming can help reduce erosion. Returning crop residue to the soil or regularly adding other organic material helps to keep the soil in good condition.

If this soil is used as pasture or for hay, overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil and the pasture plants in good condition.

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of herbicides or by mechanical removal.

This soil generally is suited to sanitary facilities and building site development if proper design and

installation procedures are used. In areas where it is moderately slowly permeable, it is poorly suited to use as septic tank absorption fields. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material.

Capability subclass IIe; woodland suitability subclass 2o.

ThC2—Theresa silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes of drumlins and ground moraines. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is brown, firm clay loam and loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Dodge, Hochheim, and St. Charles soils. These soils and the Theresa soil are in similar positions on the landscape, but Dodge and St. Charles soils have thicker silty layers and Hochheim soils are shallower to the underlying till. Also included are small areas of severely eroded Theresa soils and some areas of similar soils that are mottled in the lower part of the subsoil and in the substratum. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is medium. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is good for row crops, hay, pasture, and trees. The potential is poor to good for most engineering uses.

This soil is suited to corn, small grain, and grasses and legumes for hay and pasture. If this soil is used for cultivated crops, there is a hazard of erosion. Minimum tillage, winter cover crops, and grassed waterways help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to reduce crusting and increase water infiltration.

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

This soil is suited to commercial wood production. Plant competition is the only soil-related forest management problem. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal.

This soil generally is suited to sanitary facilities and building site development if proper design and installation procedures are used. In areas where it is moderately slowly permeable, it is poorly suited to use as septic tank absorption fields. It does not have sufficient strength and stability to support vehicular traffic or foundations of buildings, but these limitations can be overcome by strengthening or replacing the subsoil with a suitable base material. Because of the steepness of the slope, land shaping may be necessary at sites for buildings and for septic tank absorption fields unless there are areas of lesser slope within the site.

Capability subclass IIIe; woodland suitability subclass 2o.

ThD2—Theresa silt loam, 12 to 18 percent slopes, eroded. This moderately steep, well drained soil is on convex side slopes of drumlins and moraines. Areas of this map unit are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is brown, firm clay loam and loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Dodge and Hochheim soils. These soils and the Theresa soil are in similar positions on the landscape, but Dodge soils have thicker silty layers and Hochheim soils are thinner over the underlying glacial till. Also included are small areas of severely eroded Theresa soils and some areas of similar soils that are mottled in the lower part of the subsoil and in the substratum. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are farmed. The potential is fair for row crops and hay and good for pasture and trees. The potential is poor for most engineering uses.

This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, erosion is a severe hazard. Minimum tillage, winter cover crops, and grassed waterways can help prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to reduce crusting and increase water infiltration.

The use of this soil as pasture or for hay is also effective in controlling erosion. Overgrazing, grazing when the soil is too wet, or the excessive use of heavy machinery can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil-related problems in forest management are steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting can expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to most sanitary facilities and to building site development because of the steepness of slope. This limitation can be avoided or overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. This soil also lacks sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with a suitable base material.

Capability subclass IVe; woodland suitability subclass 2r.

ThE2—Theresa silt loam, 18 to 30 percent slopes, eroded. This steep, well drained soil is on convex side slopes of drumlins and moraines. Areas of this map unit are irregular in shape and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is brown, firm clay loam and loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In some areas this soil is not eroded.

Included in mapping are small areas of well drained Dodge and Hochheim soils. These soils and the Theresa soil are in similar positions on the landscape. Dodge soils have thicker silty layers than the Theresa soil. Hochheim soils are thinner over the underlying glacial till. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through this soil. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The surface layer is friable and is easily tilled at the proper moisture content. This soil is somewhat difficult to till when wet because some subsoil material is mixed in the plow layer. This soil has a tendency to crust after heavy rain and to puddle if tilled when too wet.

Most areas of this soil are used as pasture or woodland. The potential is good for pasture and trees and poor for cultivated crops. The potential is poor for most engineering uses.

If this soil is used as pasture, overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

This soil is suited to commercial wood production. Soil-related problems in forest management are steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by shaping the site. Construction of local roads and streets generally requires extensive cutting and filling. This soil does not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the subsoil with a suitable base material.

Capability subclass VIe; woodland suitability subclass 2r.

TrD3—Theresa soils, 12 to 25 percent slopes, severely eroded. These moderately steep and steep, well drained soils are on convex side slopes of drumlins and moraines. The original surface layer has been entirely removed by erosion. In places, most of the upper part of the subsoil has been lost. Areas of this map unit are irregular in shape and range from 5 to 10 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 8 inches thick. The subsoil is about 23

inches thick. The upper part of the subsoil is dark yellowish brown, firm silty clay loam; the lower part is brown, firm clay loam. The substratum, to a depth of about 60 inches, is light yellowish brown sandy loam. In places, the surface layer is clay loam or loam.

Included in mapping are small areas of well drained Hochheim soils. Hochheim soils and the Theresa soils are in similar positions on the landscape, but the Hochheim soils are thinner over the underlying glacial till. Also included are small areas of eroded Theresa soils that have a silt loam surface layer. The included soils make up about 15 percent of the map unit.

Water and air move at a moderate or moderately slow rate through these soils. Surface runoff in cultivated areas is rapid. The available water capacity is high, and natural fertility is high. The shrink-swell potential is moderate in the subsoil and low in the substratum. The organic matter content of the surface layer is low. The surface layer is firm and can be tilled only within a narrow range in moisture content without puddling and clods forming.

Most areas of these soils are used as pasture or for trees. The potential is poor for row crops and hay, fair for pasture, and good for trees. The potential is very poor for most engineering uses.

The use of these soils as pasture or for hay is effective in controlling erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods can help to keep the pasture plants and the soil in good condition.

These soils are suited to commercial wood production. Soil-related problems in forest management are steepness of the slope and brush encroachment following harvest. Planting trees on the contour and carefully locating skid roads during harvest can minimize erosion and improve equipment trafficability. Seedling survival rates on steeper slopes that face south or west can be increased by careful planting and by using vigorous planting stock. Vegetation that can compete with natural regeneration following harvest can be controlled through the use of suitable herbicides or by mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

These soils are poorly suited to most sanitary facilities and to building site development because of the steepness of the slope. This limitation can be overcome by using included areas of lesser slope or by land shaping. Construction of local roads and streets generally requires extensive cutting and filling. These soils do not have sufficient strength to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the soil with a suitable base material.

Capability subclass VIe; woodland suitability subclass 2r.

Ud—Udorthents, loamy. These nearly level and gently sloping, dominantly well drained soils are in filled and smoothed areas on uplands and along rivers and lakes. Individual areas are rectangular or long and narrow and range from 5 to 45 acres in size. Slopes range from 0 to 3 percent.

Udorthents vary in color. They are dominantly loamy but have sandy strata and in places are gravelly. The fill ranges from about 3 to more than 5 feet in thickness.

Included with these soils in mapping are some areas where the fill contains cinders, broken concrete, and other nonsoil material. Also included, mainly along the edges of the filled areas, are areas where the slope is as much as 20 percent. Included areas make up about 35 percent of the map unit.

Water and air generally move slowly through these soils, but the rate varies. Runoff is slow or ponded. The available water capacity and natural fertility vary.

Some areas are covered by roads, parking lots, or buildings. Others are cropped. Topsoil has been added in some of the cropped areas. These soils have poor or fair potential for cultivated crops, pasture, and trees. They have fair or good potential for most engineering uses.

These soils generally are poorly suited to crops and trees. Plants can be grown in the areas where the soils do not contain cinders, broken concrete, or other nonsoil material, especially in the areas where topsoil has been added.

These soils are suited to building site development, but wet basements are a problem in the areas along rivers and lakes. The suitability for sanitary facilities varies.

These soils are not assigned to a capability subclass or a woodland suitability subclass.

Uf—Udifluvents. These nearly level and gently sloping, well drained to somewhat poorly drained soils are on flood plains and in depressions. They are subject to occasional brief periods of flooding. The areas are long and narrow or irregular in shape and range from 5 to 40 acres in size. Slopes are 0 to 3 percent.

Udifluvents are variable in color and texture but typically consist of stratified silty and loamy layers to a depth of about 60 inches. In places, there are sandy layers.

Included in mapping are small areas of very poorly drained Adrian Variant, Houghton, and Palms soils and poorly drained Pella soils. These soils are in depressions. Adrian Variant, Houghton, and Palms soils have an organic layer that is more than 16 inches thick. Pella soils are underlain by glacial drift. The included soils make up about 10 percent of the map unit.

Water and air movement through these soils is variable but is mainly at a moderate rate. Surface runoff in cultivated areas is medium. The available water capacity is variable, and natural fertility is medium. These

soils are saturated to a depth of more than 1 foot for several months during wet seasons. The surface layer is friable and is easily tilled within a fairly wide range in moisture content. It does, however, have a tendency to crust after heavy rain. Root development of many crops is restricted by the water table.

Most areas of these soils are in pasture or woodland. The potential is good for pasture and trees. The potential is poor for most engineering uses.

These soils are suited to pasture or hay. These uses are effective in controlling erosion. Overgrazing or grazing when these soils are too wet, however, can cause surface compaction, excessive runoff, and poor tilth. A proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture plants and the soil in good condition. These soils are suited to trees.

These soils are poorly suited to building site development and sanitary facilities because of wetness and the hazard of flooding.

Capability subclass IIw; woodland suitability subclass not assigned.

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 and as sites for buildings, highways and other transportation systems, sanitary facilities, parks and other recreation facilities, and 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

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 "Detailed soil map units." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 396,500 acres in the survey area was used for crops and pasture in 1967 (*11*). Of this total, about 36,800 acres was used for permanent pasture; 144,600 acres was used for row crops, mainly corn; 91,500 acres was used for close-grown crops, mainly wheat and oats; and 94,000 acres was used for hay and pasture, in rotation.

The potential of the soils in Dodge County for increased production of food is good. About 21,100 acres of potentially good cropland is currently used as woodland, and about 27,900 acres is used for pasture. In addition to the reserve productive capacity of this survey area, productivity could also be increased considerably by applying the latest crop production techniques to all cropland in the county.

The acreage in crops and pasture has gradually decreased as more and more land is used for urban development. In 1967, urban and built-up land in the county took in an estimated 33,500 acres.

Soil erosion is the major soil problem on about two-thirds of the cropland and pasture in Dodge County. If the slope is more than 2 percent, erosion is a hazard. Some of the somewhat poorly drained soils, such as Ashippun, Kibbie, and Nenno soils, have slopes of 2 to 6 percent. On these soils, not only is erosion a hazard, but also wetness is a problem.

Erosion of the surface layer is a problem for two reasons. First, productivity is reduced if the surface layer

is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils, such as the Neda Variant soils, that have a clayey subsoil and to soils that have a layer in or below the subsoil that limits the depth of the root zone.

On many of the more sloping soils, preparing a good seedbed and tilling are difficult because the original friable surface soil has been eroded away leaving a moderately fine textured surface layer. Severely eroded Fox, Hochheim, Miami, and Theresa soils are examples. Erosion also reduces the productivity of soils that tend to be droughty, such as Casco loam and Hochheim soils.

Second, soil eroded from farmland adds to the sediment level of streams. Controlling erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, recreation, and fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, the legume and grass forage crops in the cropping system reduce erosion on sloping land; they also provide nitrogen and improve tilth for the following crop.

Minimum tillage and crop residue left on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be used on most soils in the survey area. The acreage of corn being grown without tillage is increasing annually. This no-tillage practice is effective in reducing erosion and can be used successfully on most soils in the survey area.

Terraces and diversions reduce the length of slope and help control runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Plano soils and some St. Charles soils are suited to terraces. Other soils are less suited to terraces and diversions because of irregular slopes, excessive wetness in the terrace channels, or bedrock at a depth of less than 20 inches.

Contouring and contour stripcropping are also used to control erosion in the survey area. The soils best suited to these practices are those that have smooth, uniform slopes; most areas of the Dodge, McHenry, Miami, Plano, St. Charles, and Sisson soils have slopes greater than 2 percent (fig. 11).

Soil blowing is a hazard on the sandy Chelsea soils and the mucky Adrian Variant, Houghton, and Palms soils that are drained and cultivated. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Controlling drainage or maintaining a vegetative cover, surface mulch, or a rough surface through proper tillage minimizes soil blowing on these soils. Windbreaks of suitable trees and shrubs such as lilac or silky dogwood effectively reduce soil blowing on muck soils.

Information concerning erosion control practices for each kind of soil in the survey area is available at local offices of the Soil Conservation Service.

Soil drainage is the major management need on about one-third of the acreage used for crops and pasture in the survey area. The poorly drained or very poorly drained Ackmore, Brookston, Colwood, Keowns, Otter, Pella, and Sebewa soils, which make up about 46,470 acres in the survey area, are naturally so wet that, unless drained, the production of crops common to the area is generally not possible. Also in this category are the organic Adrian Variant, Houghton, and Palms soils, which make up about 45,100 acres.

Unless artifically drained, the somewhat poorly drained soils are so wet that crops are damaged during most years. In this category are the Elburn, Kibbie, Lamartine, and Nenno soils, which make up about 66,240 acres. Artificial drainage is needed in small areas of the wetter soils along drainageways and in swales that are commonly included in areas of the moderately well drained Ionia and Mayville soils, especially those that have slopes of 2 to 6 percent.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of the poorly drained and very poorly drained soils that are used for intensive row cropping. Drains have to be more closely spaced in slowly permeable soils than in the more permeable soils.

Organic soils oxidize and subside when the pore space is filled with air; therefore, special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of organic soils. Controlled drainage can also be used to reduce soil blowing. Information on drainage for each kind of soil in the survey area is available in local offices of the Soil Conservation Service.

Fertility is naturally medium or high in most soils of the uplands in the survey area. Most of these soils are naturally acid in the surface layer. The soils on flood plains, such as Otter and Sebewa soils, range from slightly acid to mildly alkaline in the surface layer and are naturally higher in fertility than most upland soils.

Upland soils that are naturally acid or that have become acid through cropping require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops that grow best on nearly neutral soils. The levels of available phosphorus and potassium are naturally low in most of these soils. On all soils, application of lime and fertilizer should be based on results of soil tests, the need of the crop, and the expected level of yields. The Cooperative Extension Service can help determine the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that are granular and porous have good tilth.

Most of the soils that are used for crops in the survey area have a silt loam surface layer that is light in color

Figure 11.—Stripcropping helps to control erosion in these areas of Elburn, McHenry, and St. Charles soils.

and relatively low in content of organic matter. Generally the structure of such soils is weak, and intense rainfall causes the formation of a crust on the surface. The crust is hard when it is dry, and it is nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help to improve soil structure and reduce crust formation.

The soils and climate of this survey area are suited to many field crops that are not commonly grown. Corn and, to an increasing extent, soybeans are the common row crops. Alfalfa and oats are also common.

Vegetables, small fruits, tree fruits, and nursery plants are the special crops that are grown commercially in the survey area. About 35,000 acres is used for sweet corn, cucumbers, green peas, and other vegetables. Tree fruits commonly grown in the county are apples, pears, plums, and cherries. Grapes are grown on some farms.

Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. In the survey area, Dodge, Miami, Puchyan, and St. Charles soils, which have slopes of less than 6 percent, are examples of such soils. Crops generally can be planted and harvested earlier on these soils than on the other soils in the survey area.

If adequately drained, the muck soils in the county are suited to certain vegetable and specialty crops. Adrian Variant, Houghton, and Palms soils, which make up about 45,100 acres in the survey area, are examples.

Most of the well drained soils in the survey area are suited to orchards and nursery plants. Soils in low positions where frequent frost is a hazard and air drainage is poor, however, are generally poorly suited to early vegetables, small fruits, and orchards.

The latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 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 soil is not suited to the crop or the crop is 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 (*3*).

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 Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

capability classification

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 (*10*). 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 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 woodland or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

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, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 5. Miscellaneous areas and soils classified at a level higher than the series are excluded. 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 map unit in the section "Detailed soil map units."

woodland management and productivity

George W. Alley, forester, Soil Conservation Service, assisted in preparing this section.

Before settlement, about half of Dodge County was a forest of southern hardwoods. The rest was either tall grass prairie or prairie and white oak, bur oak, and red oak in groves (*5*).

At present, about 42,700 acres, or 8 percent of the land area, is forested. Of this, about 25 percent is elm-ash-cottonwood, 23 percent is maple-beech-birch, 19 percent is oak-hickory, 15 percent is aspen-birch, 7 percent is a mixture of conifers, and 11 percent is nonstocked (*13*).

The economic value of the forested acreage for recreation use and wildlife habitat far exceeds its value for commercial wood production. On some of this acreage, trees are harvested for sawlogs, veneer logs, and pulpwood to supplement farm income.

Table 6 contains information useful to woodland owners or forest managers in planning use of the soils for wood crops. Only those 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* were not made because most slope gradients are low enough that erosion is not a problem if proper logging techniques are used.

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.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important 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 suited to the soils and to commercial wood production.

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, from nurserymen, or from the Wisconsin Department of Natural Resources.

engineering

Peg S. Whiteside, soil mechanics engineer, Soil Conservation Service, assisted in the preparation of this section.

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.

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. If pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed 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, shear strength, 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 areas; (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 feet. Also, because of the large scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil are 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; and table 11, 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, and 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 and that any limitations are 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 that are rated severe, 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 5 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 foundation 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*, and *poor*, which mean about the same as *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 60 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, a filter mound can be constructed over wet or impervious soils or soils that are underlain by bedrock, 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 if the seasonal high water table is above the level of the lagoon floor. If 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 5 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.

If 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 site 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 material. Each soil is evaluated to the depth observed, generally about 5 or 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 below the surface layer to a depth of 5 or 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, low frost action 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 5 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.

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 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 or stones.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel or stones; 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 the soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 11 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

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; alkalinity; and availability of outlets for drainage.

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, availability of potential water impoundment sites, 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 or hardpan 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.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They should have a surface that is free of stones and boulders and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

wildlife habitat

Steve F. Baima, biologist, Soil Conservation Service, assisted in preparing this section.

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.

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. Poorly drained and very poorly drained soils, except Houghton, ponded, soils are rated after drainage. 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 habitat 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, wheat, 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, lovegrass, bromegrass, clover, and alfalfa.

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, 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 hardwood plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, and blackberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, 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, 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, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, 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 ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed 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, shore birds, muskrat, mink, and beaver.

The essential habitat elements of a selected species of wildlife are generally dependent on several kinds of soil and a combination of land uses. For this reason, the soil associations described in the section "General soil map units" are grouped into four wildlife areas that differ in the kind of wildlife species that inhabit them and in potential for development of wildlife habitat. The true value of each wildlife area is dependent on its interspersion with the other areas, and the diversity of wildlife is dependent on the diversity of soils, land uses, and management in all of the wildlife areas.

wildlife area 1

This wildlife area consists of the St. Charles-LeRoy-Lomira, Theresa-Lamartine-Hochheim, St. Charles-Miami-Elburn, and McHenry-Pella associations. The soils range from nearly level to steep and from well drained to poorly drained. These soils are mostly silty and are underlain by glacial till. Dairy farming and the growing of general or specialty crops is the predominant land use. Many of the soils in this area are plowed in the fall. This practice significantly affects wildlife because plowing covers the crop residue and waste grain, which provide important winter food and cover. Some of the steeper soils and wet soils in drainageways and depressions are not farmed and remain in woodland or are used as wetland wildlife habitat. Most of the wet soils in this area are drained.

The interspersed wetlands, woodland, and agricultural land provide the diversity required by many game and nongame species of wildlife. The soils in this wildlife area have good potential for habitat development. Some of the soils are suited to ponds. Hardwood trees, shrubs, and cultivated crops grow well on these soils.

The major wildlife species in this area are pheasant, cottontail rabbit, squirrel, white-tailed deer, red fox, duck, Wilson's snipe, and woodcock.

wildlife area 2

This wildlife area is made up of the Fox-Casco-Rodman association. The soils range from nearly level to steep and are well drained and excessively drained. These soils are silty and loamy and are underlain by sand and gravel outwash. Dairy farming and growing of general farm crops is the predominate land use. Many of the cultivated areas are plowed in spring, thus, crop residue and waste grain are available for winter food and cover. Many of the steeper soils and Rodman soils are not farmed and remain in woodland. Wet soils in potholes in areas of "pitted" outwash are common. Most of these wetlands are not suited to drainage, but they do dry up periodically. Farm fields are generally smaller than in other wildlife areas, and diversity of land use is greater than in other areas.

This combination of agricultural land, woodland, and wetland, provides the diverse habitat required by many game and nongame species of wildlife. The soils in this wildlife area have good potential for habitat development. Wetland development is mostly limited to blasting or dredging of existing potholes. Hardwood trees, shrubs, and cultivated crops grow well on Fox soils. Casco soils are less suited to these uses because of the moderate available water capacity. Rodman soils have very low available water capacity and are mostly in woodland.

Major wildlife species in this area include white-tailed deer, gray and fox squirrel, cottontail rabbit, gray and red fox, and raccoon.

wildlife area 3

This wildlife area consists of the Houghton-Pella association. This association consists of nearly level, poorly drained and very poorly drained organic and mineral soils. This wildlife area is mostly near major lakes and along major drainageways. The Horicon National Wildlife Refuge, a major resting spot for migrating ducks and geese, is in this wildlife area. Much of this area is covered with water most of the year and is used as wetland wildlife habitat. Some undrained areas are used for pasture or marsh hay. Drained areas are used mostly for corn or specialty crops. The farm fields are generally large, and there is little diversity of land use. Many of the wetlands are not suited to drainage because they are adjacent to major lakes and drainageways. The soils, topography, and hydrologic conditions in this wildlife area provide excellent opportunities for development of habitat for wetland wildlife. Fresh meadows, shallow marshes, deep marshes, open water, and shrub swamp are the most common types of wetland (*7*).

Major wildlife species in this area include waterfowl and furbearers such as muskrat, mink, and raccoon. Numerous nongame species, particularly birds and reptiles, are also quite common in this area.

wildlife area 4

This wildlife area takes in the Plano-Mendota association. The soils are nearly level to sloping and are well drained and moderately well drained. These are silty soils that are underlain by glacial till. Nearly all of this area is used for dairy farming. Some specialty and cash-

grain crops are also grown. Many of the soils in this area are plowed in the fall. This practice significantly affects wildlife because plowing covers the crop residue and waste grain, which provide important winter food and cover. This wildlife area was prairie grassland before settlement. There are a few wooded areas along drainageways and in wet depressions. There is little diversity of land use to provide good wildlife habitat, but the soils in this wildlife area have good potential for habitat development. Wet soils are of minor extent in this area, but they provide good habitat for wetland wildlife. These wet soils are also suited to ponds.

The major wildlife species are pheasant and cottontail rabbit. Ducks and geese use this area as a feeding ground.

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 can 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, and data obtained from physical and chemical laboratory analyses of soils.

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 their 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.

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. Range in liquid limit and in plasticity index is 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.

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. In table 15 it is expressed as inches of water per inch of soil.

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.

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.

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.

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 or with runoff from adjacent slopes. 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 or ponding 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 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 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.

Subsidence is the settlement of organic soils or of soils containing semifluid layers. Initial subsidence generally results from drainage. Total subsidence is initial subsidence plus the slow sinking that occurs over a period of several years as a result of the oxidation or compression of organic material.

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.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*12*). 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 Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of 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 Haplaquolls (*Hapl*, meaning simple horizons, plus *aquoll*, the suborder of Mollisols that have an aquic 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 Haplaquolls.

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 Haplaquolls.

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.

soil series and their 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 (*9*). Unless otherwise noted, 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 "Detailed soil map units."

Ackmore series

The Ackmore series consists of deep, poorly drained, moderately slowly permeable soils on flood plains and alluvial fans. These soils formed in silty alluvium or colluvium over an older, buried soil. Slopes are 0 to 3 percent.

Ackmore soils are commonly near Elburn and Pella soils on the landscape. Elburn soils have an argillic

horizon, are somewhat poorly drained, and do not have older buried soil horizons. Pella soils have a mollic epipedon and do not have older buried soil horizons.

Typical pedon of Ackmore silt loam, 0 to 3 percent slopes, 2,650 feet south and 100 feet east of the NW corner of sec. 13, T. 9 N., R. 15 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; mildly alkaline; abrupt smooth boundary.

C1—10 to 14 inches; stratified grayish brown (10YR 5/2), dark gray (10YR 4/1), and brown (10YR 5/3) silt loam; few fine faint and distinct yellowish brown (10YR 5/4) mottles; weak thin platy structure; friable; medium acid; gradual smooth boundary.

C2—14 to 26 inches; very dark grayish brown (10YR 3/2) silt loam; few fine prominent dark reddish brown (5YR 3/2) mottles; massive; friable; mildly alkaline; clear smooth boundary.

IIA1b—26 to 36 inches; black (10YR 2/1) silty clay loam; moderate medium subangular blocky structure; firm; mildly alkaline; gradual smooth boundary.

IIB2b—36 to 60 inches; olive gray (5Y 5/2) silty clay loam; massive; firm; mildly alkaline.

The thickness of the A and C horizons ranges from 20 to 36 inches.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. The C horizon has value of 3 to 5 and chroma of 1 to 3 and ranges from medium acid to neutral. The IIAb horizon has hue of 10YR or 5Y and value of 2 or 3. It is silty clay loam or silt loam and ranges from medium acid to mildly alkaline. The IIBb horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 to 5; and chroma of 1 or 2. It is silty clay loam or silt loam and ranges from medium acid to mildly alkaline.

Adrian Variant

The Adrian Variant consists of deep, very poorly drained, slowly permeable soils in depressions on glacial lake plains. These soils formed in organic layers that derived mainly from sedge and reed vegetation and from the underlying sedimentary peat deposits, which are over sandy and silty deposits. Slopes are 0 to 2 percent.

Adrian Variant soils are commonly near Houghton, Keowns, and Pella soils on the landscape. Houghton soils have thicker organic layers than Adrian Variant soils. Keowns and Pella soils formed in mineral material and are poorly drained.

Typical pedon of Adrian Variant muck, 1,650 feet west and 650 feet south of the NE corner of sec. 31, T. 10 N., R. 17 E.

Oa1—0 to 10 inches; black (5Y 2/1) broken face and rubbed sapric material, less than 5 percent fiber, a trace rubbed; weak coarse granular structure; primarily herbaceous fibers; mildly alkaline; clear smooth boundary.

Oa2—10 to 16 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material, less than 5 percent fiber, a trace rubbed; weak coarse granular structure; primarily herbaceous fibers; neutral; abrupt smooth boundary.

Lco—16 to 24 inches; very dark gray (N 3/0) sedimentary peat; massive; friable; about 5 percent fine sand; neutral; abrupt smooth boundary.

IICg—24 to 60 inches; dark gray (N 4/0) stratified fine sand and coarse silt; massive; friable; strong effervescence; moderately alkaline.

The organic layers range from 16 to 51 inches in thickness. The upper sapric layers have hue of 10YR, 2.5Y, 5Y, or 7.5YR; value of 2; and chroma of 0 to 2. Some pedons have thin layers of hemic material or woody fragments. Reaction is neutral or mildly alkaline. The Lco horizon is similar in color to the sapric layers and ranges from 6 to 30 inches in thickness. In many pedons, it contains thin layers of marl or a considerable number of shells. The IIC horizon is stratified fine sand and coarse silt or sand. It has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 0 to 1. Reaction is mildly alkaline or moderately alkaline.

Ashippun series

The Ashippun series consists of deep, somewhat poorly drained, moderately slowly permeable soils on ground moraines and terraces and on foot slopes of drumlins. These soils formed in silty sediment and in the underlying loamy glacial drift that derived partly from shale. Slopes range from 0 to 6 percent.

Ashippun soils are commonly near Neda and Neda Variant soils on the landscape. They formed in similar material. Neda soils are moderately well drained. Neda Variant soils are moderately well drained and are shallower to the underlying shale than Ashippun soils.

Typical pedon of Ashippun silt loam, 2 to 6 percent slopes, 2,300 feet south and 1,000 feet east of the NW corner of sec. 14, T. 11 N., R. 16 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium and fine granular structure; friable; mildly alkaline; abrupt smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak thick platy structure parting to moderate fine subangular blocky; friable; mildly alkaline; abrupt smooth boundary.

B21t—11 to 20 inches; olive brown (2.5Y 4/4) silty clay loam; many fine distinct yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; many fine shale fragments; very dark grayish brown (2.5Y 3/2) clay films on faces of peds; mildly alkaline; gradual wavy boundary.

IIB22t—20 to 26 inches; olive brown (2.5Y 4/4) clay loam; many fine distinct yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; many fine shale fragments; very dark grayish brown (2.5Y 3/2) clay films on faces of peds; mildly alkaline; gradual wavy boundary.

IIC1—26 to 30 inches; grayish brown (2.5Y 5/2) loam; common fine prominent yellowish brown (10YR 5/8) mottles; weak thick platy structure parting to weak fine subangular blocky; very friable; common pebbles, cobblestones, and shale fragments; strong effervescence; moderately alkaline; abrupt smooth boundary.

IIC2—30 to 60 inches; light olive brown (2.5Y 5/4) and light yellowish brown (2.5Y 6/4) loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 20 to 40 inches. The thickness of the silty material over glacial till ranges from 10 to 20 inches. Reaction in the solum is neutral or mildly alkaline.

The Ap or A1 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. The B2t horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 3 or 4. It is silty clay loam or silt loam. The IIB2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is clay loam, shaly clay loam, or loam. The IIC horizon has hue of 2.5Y or 10YR and value and chroma of 4 or 5. The content of coarse fragments, mostly shale, in the IIC horizon ranges from 5 to 25 percent.

Brookston series

The Brookston series consists of deep, very poorly drained, moderately permeable or moderately slowly permeable soils in depressions on ground moraines and along drainageways. These soils formed in silty sediment and in the underlying loamy glacial till. Slopes are 0 to 3 percent.

Brookston soils are commonly near Ashippun, Lamartine, and Pella soils on the landscape. Ashippun soils are somewhat poorly drained and are underlain by shaly glacial till. Lamartine soils are more silty in the upper part of the solum than the Brookston soils and are somewhat poorly drained. Pella soils are poorly drained and do not have an argillic horizon. Brookston soils are deeper to free carbonates than the Pella soils.

Typical pedon of Brookston silt loam, 0 to 3 percent slopes, 2,250 feet south and 1,600 feet east of the NW corner of sec. 28, R. 15 E., T. 9 N.

Ap—0 to 8 inches; black (10YR 2/1) silt loam; weak fine subangular blocky and granular structure; friable; neutral; abrupt smooth boundary.

A12—8 to 12 inches; very dark gray (10YR 3/1) silt loam; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B1g—12 to 16 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine faint brown (10YR 5/3) and distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; neutral; clear wavy boundary.

B21tg—16 to 20 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) and common fine prominent light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; firm; few thin clay films on faces of peds; neutral; gradual wavy boundary.

IIB22tg—20 to 30 inches; dark grayish brown (2.5Y 4/2) clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; few thin very dark grayish brown (10YR 3/2) streaks; moderate medium subangular blocky structure; firm; few thin clay films on faces of peds; few fine pebbles; neutral; gradual wavy boundary.

IIB3—30 to 36 inches; grayish brown (2.5Y 5/2) loam; many fine and medium prominent yellowish brown (10YR 5/6) and distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; few fine pebbles; neutral; abrupt wavy boundary.

IIC—36 to 60 inches; grayish brown (2.5Y 5/2) sandy loam; many medium prominent light olive brown (2.5Y 5/6) mottles; massive; very friable; about 5 percent gravel; common cobblestones and large pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 24 to 45 inches. Depth to glacial till ranges from 12 to 30 inches. The thickness of the mollic epipedon ranges from 11 to 14 inches.

The Ap or A1 horizon has value and chroma of 2 or 3. The B and IIB horizons have hue of 10YR, 5Y, or 2.5Y; value of 4 to 6; and chroma of 1 or 2. Content of coarse fragments in the IIB horizon ranges from 0 to 15 percent. The IIC horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 5. It is sandy loam, loam, or, less commonly, clay loam. Content of coarse fragments in the IIC horizon ranges from 5 to 15 percent and includes cobblestones and flagstones.

Casco series

The Casco series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the lower part. These soils are on glacial outwash terraces, kames, eskers, and moraines. They formed in loamy deposits over stratified sand and gravel. Slopes range from 2 to 30 percent.

Casco soils are commonly adjacent to Fox and Rodman soils on the landscape. Fox soils are thicker over sand and gravel than Casco soils. Rodman soils are thinner over sand and gravel and lack an argillic horizon.

Typical pedon of Casco loam, 2 to 6 percent slopes, 2,300 feet north and 2,000 feet east of the SW corner of sec. 33, T. 10 N., R. 17 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak medium granular structure; friable; mildly alkaline; abrupt smooth boundary.
A2—8 to 11 inches; brown (10YR 5/3) loam; weak medium platy structure; friable; slightly acid; clear abrupt boundary.
B2t—11 to 20 inches; dark brown (10YR 4/3) clay loam; moderate medium subangular blocky structure; firm; thick patchy clay films on faces of peds; neutral; abrupt wavy boundary.
IIC—20 to 60 inches; brown (10YR 5/3) sand and gravel; stratified; single grained; loose; strong effervescence; moderately alkaline.

The thickness of the solum and depth to sand and gravel range from 12 to 24 inches. Gravel content in the solum ranges from 0 to 35 percent.

The Ap horizon has value of 4 and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. The A2 horizon, if present, has value of 5 and chroma of 2 or 3. The B2t horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. It is clay loam, loam, or sandy clay loam and ranges from medium acid to mildly alkaline. The IIC horizon has value of 5 or 6 and chroma of 4 to 6. It is mildly alkaline or moderately alkaline. Strata of sand and gravel range from one-half foot to several feet in thickness.

Channahon series

The Channahon series consists of shallow, well drained, moderately permeable soils on ground moraines. These soils formed in loess and in the underlying loamy glacial till, which is underlain by dolomite. Slopes range from 1 to 30 percent.

Channahon soils are commonly adjacent to Knowles and Markesan soils on the landscape. Knowles soils are thicker over dolomite than Channahon soils and have a thinner or lighter colored surface layer. Markesan soils are underlain by gravelly loam glacial till that contains a large amount of dolomite fragments.

Typical pedon of Channahon silt loam, 1 to 6 percent slopes, 1,800 feet north and 1,600 feet east of the SW corner of sec. 11, T. 13 N., R. 13 E.

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam; moderate fine granular structure; friable; medium acid; abrupt smooth boundary.
A12—9 to 13 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine subangular blocky structure; friable; slightly acid; clear wavy boundary.
B2t—13 to 18 inches; dark brown (10YR 3/3) silty clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; estimated 10 percent gravel; neutral; abrupt irregular boundary.
IIR—18 to 60 inches; light brownish gray (2.5Y 6/2) creviced dolomite.

The thickness of the solum and depth to dolomite range from 10 to 20 inches. The thickness of the mollic epipedon ranges from 6 to 14 inches. The volume of dolomite fragments and flagstones in the solum ranges from 0 to 20 percent.

The Ap horizon has value and chroma of 2 or 3. The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is silty clay loam, clay loam, or loam, and ranges from slightly acid to moderately alkaline. Gravel content ranges from 0 to 10 percent. The IIR horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 2 or 3. In most places, the dolomite is hard and unweathered; in other places, it is weathered and creviced, and soil material from the B2t horizon fills these crevices.

Chelsea series

The Chelsea series consists of deep, excessively drained, rapidly permeable soils on uplands. These soils formed in eolian fine sand. Slopes range from 2 to 18 percent.

Chelsea soils are commonly adjacent to Puchyan and Sisson soils on the landscape. Puchyan soils formed in layers of sandy, loamy, and silty material. Sisson soils formed in loamy lacustrine material that is underlain by silt and very fine sand.

Typical pedon of Chelsea loamy fine sand, 2 to 6 percent slopes, 800 feet south and 250 feet west of the NE corner of sec. 7, T. 10 N., R. 13 E.

Ap—0 to 9 inches; brown (10YR 4/3) loamy fine sand; single grained; loose; medium acid; abrupt smooth boundary.
A21—9 to 17 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; medium acid; abrupt wavy boundary.
A22—17 to 38 inches; dark brown (10YR 4/3) fine sand; single grained; loose; medium acid; abrupt wavy boundary.
A&B—38 to 60 inches; dark brown (10YR 3/3) fine sand; single grained; loose; 1/8- to 1 3/8-inch-thick bands of yellowish brown (10YR 5/3) loamy fine sand; clay bridging between sand grains; medium acid.

The thickness of the solum and sandy deposits is more than 5 feet. Reaction below the A1 or Ap horizon is strongly acid or medium acid. The depth to the uppermost lamella ranges from 27 to 48 inches.

The Ap or A1 horizon has value of 4 or 5 and chroma of 1 to 3. The A2 horizon has value of 4 or 6 and chroma of 3 to 6. The B horizon consists of lamellae 1/8 to 1/2 inch thick, which total less than 6 inches in the

upper 60 inches. It has hue of 10YR or 7.5YR and value and chroma of 3 or 4. It is loamy sand or loamy fine sand.

Colwood series

The Colwood series consists of deep, poorly drained and very poorly drained, moderately permeable soils on glacial lake plains. These soils formed in silty lacustrine deposits that are underlain by fine sandy loam stratified with fine sand and silt. Slopes are 0 to 2 percent.

Colwood soils are commonly near Granby Variant, Keowns, and Pella soils on the landscape. Granby Variant soils are mostly sandy throughout. Keowns soils are mostly silty throughout, and Pella soils are silty and are underlain by glacial drift.

Typical pedon of Colwood silty clay loam, 2,150 feet north and 200 feet west of the SE corner of sec. 3, T. 9 N., R. 17 E.

Ap—0 to 12 inches; black (10YR 2/1) silty clay loam; moderate medium granular structure; firm; mildly alkaline; abrupt smooth boundary.

A12—12 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak medium subangular blocky structure; firm; mildly alkaline; clear smooth boundary.

B1g—16 to 22 inches; grayish brown (2.5Y 5/2) silt loam; many fine prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; mildly alkaline; clear smooth boundary.

B2g—22 to 28 inches; light olive gray (5Y 6/2) silty clay loam; few medium prominent yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; mildly alkaline; abrupt smooth boundary.

IIC—28 to 60 inches; brown (10YR 5/3) and olive gray (5Y 5/2) fine sandy loam stratified with yellowish brown (10YR 5/6) fine sand and olive gray (5Y 5/2) silt; massive; very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 22 inches.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 5Y, 2.5Y, or 10YR; value of 4 to 6; and chroma of 1 or 2. It is silty clay loam, silt loam, and, less commonly, loam. Reaction ranges from slightly acid to moderately alkaline. The IIC horizon has hue of 10YR, 5Y, or 2.5Y; value of 4 to 6; and chroma of 1 to 3. It is dominantly fine sandy loam stratified with fine sand and silt, but strata of silty clay loam and loamy fine sand are in some pedons.

Dodge series

The Dodge series consists of deep, well drained, moderately permeable soils on drumlins and ground moraines. These soils formed in loess and in the underlying loamy glacial till of moderate to high carbonate content. Slopes range from 0 to 12 percent.

Dodge soils are commonly near Juneau, Pella, and St. Charles soils on the landscape. Juneau soils are underlain by silt loam. St. Charles soils are thicker over glacial till than Dodge soils. Pella soils have a mollic epipedon, are poorly drained, and are thicker over glacial till.

Typical pedon of an uneroded part of Dodge silt loam, 6 to 12 percent slopes, eroded, 100 feet north and 1,000 feet east of the SW corner of sec. 22, T. 11 N., R. 15 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 11 inches; brown (10YR 5/3) silt loam; moderate thin and medium platy structure; very friable; very pale brown (10YR 7/3) uncoated silt grains on faces of peds; neutral; clear smooth boundary.

B1—11 to 17 inches; dark brown (10YR 4/3) silt loam; weak thick platy structure parting to moderate fine subangular blocky; friable; very pale brown (10YR 7/3) uncoated silt grains on faces of peds; slightly acid; clear wavy boundary.

B21t—17 to 24 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine and medium subangular blocky structure; firm; very pale brown (10YR 7/3) uncoated silt grains on vertical faces of peds; thin patchy clay films on some faces of peds; strongly acid; clear wavy boundary.

B22t—24 to 29 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

IIB23t—29 to 35 inches; dark brown (7.5YR 4/4) clay loam; moderate medium and coarse subangular blocky structure; firm; continuous thick clay films on faces of peds; slightly acid; clear wavy boundary.

IIC—35 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 24 to 40 inches. The thickness of the loess mantle ranges from 24 to 30 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The A2 horizon, if present, has value of 4 or 5 and chroma of 2 or 3. The B horizon has value of 4 or 5 and chroma of 4 to 6. The IIB horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or sandy clay loam. Reaction in the B and IIB horizons is strongly acid to slightly acid. The IIC horizon

has value and chroma of 4 or 5. It is gravelly loam or gravelly sandy loam and, less commonly, silt loam. Gravel content ranges from 10 to 25 percent; cobblestones and stones range from 1 to 5 percent.

Elburn series

The Elburn series consists of deep, somewhat poorly drained, moderately permeable soils on ground moraines and on foot slopes of drumlins. These soils formed in loess and in the underlying loamy glacial drift. Slopes are 0 to 3 percent.

Elburn soils are commonly near Pella, Plano, and Mendota soils. Pella soils are poorly drained and do not have an argillic horizon. Plano soils formed in similar material but are well drained and moderately well drained. Mendota soils are well drained and are underlain by glacial till that contains a large amount of carbonates and dolomite fragments.

Typical pedon of Elburn silt loam, 0 to 3 percent slopes, 50 feet north and 2,300 feet east of the SW corner of sec. 8, T. 10 N., R. 15 E.

A1—0 to 18 inches; black (10YR 2/1) silt loam; moderate medium granular structure; friable; mildly alkaline; gradual smooth boundary.

B1—18 to 24 inches; dark grayish brown (10YR 4/2) silt loam; few fine faint dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; friable; medium acid; gradual wavy boundary.

B21t—24 to 37 inches; dark brown (10YR 4/3) silty clay loam; common fine prominent yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—37 to 45 inches; brown (10YR 5/3) silt loam; common fine prominent yellowish brown (10YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; slightly acid; clear wavy boundary.

IIB3—45 to 48 inches; dark brown (10YR 4/3) sandy loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

IIC—48 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; many dolomite pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 40 to 65 inches. The thickness of the loess mantle ranges from 40 to 60 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches.

The A1 or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has value of 4 to 6 and chroma of 2 to 8 and ranges from medium acid to mildly alkaline. The IIB horizon has hue of 10YR or 5Y, value of 4 or 5, and chroma of 2 or 3. It is sandy loam, loam, or, less commonly, clay loam. Reaction ranges from slightly acid to mildly alkaline. The IIC horizon has hue of 10YR, 5Y, or 2.5Y; value of 4 or 5; and chroma of 2 to 4. It is sandy loam, loam, or, less commonly, clay loam and ranges from mildly alkaline to moderately alkaline. Gravel content ranges from 0 to 20 percent.

Elvers series

The Elvers series consists of deep, poorly drained and very poorly drained, moderately permeable soils on flood plains and along the margin of areas of organic soils. Elvers soils formed in silty sediment that is underlain by organic deposits. Slopes are 0 to 2 percent.

Elvers soils are commonly near Ackmore, Houghton, and Palms soils on the landscape. Ackmore soils are mineral throughout. Houghton soils consist of organic material that is more than 51 inches thick. Palms soils consist of organic material that is 16 to 51 inches thick and is underlain by mineral soil material.

Typical pedon of Elvers silt loam, 2,500 feet north and 100 feet east of the SW corner of sec. 35, T. 9 N., R. 17 E.

Ap—0 to 12 inches; very dark brown (10YR 2/2) silt loam; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

C1g—12 to 20 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

C2g—20 to 32 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; friable; few thin strata of fine sand; neutral; abrupt smooth boundary.

IIOa1—32 to 46 inches; black (N 2/0) sapric material; about 1 percent fiber content consisting of dark reddish brown (5YR 3/3) leaves of sedges and reeds, none rubbed; massive; primarily herbaceous fibers; neutral; clear smooth boundary.

IIOa2—46 to 56 inches; black (N 2/0) sapric material; about 10 percent fiber content consisting of dark reddish brown (5YR 3/3) leaves of sedges and reeds, about 1 percent rubbed; massive; primarily herbaceous fibers; neutral; abrupt smooth boundary.

IIIC3—56 to 60 inches; dark gray (10YR 4/1) silt loam; few fine faint dark grayish brown (10YR 4/2) mottles; massive; friable; neutral.

The thickness of the silty material ranges from 16 to 40 inches. The organic layer below the mineral material is at least 20 inches thick.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. The Cg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 0 to 2. Reaction ranges from slightly acid to mildly alkaline. The IIOa horizon has

hue of 10YR, 2.5Y, or 5Y; value of 2; and chroma of 0 to 2. Reaction is slightly acid or neutral. In some pedons, the organic layer extends to a depth of more than 60 inches. It contains thin layers of hemic material or woody fragments in some pedons. The IIIC3 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 0 or 1. It is silt loam, loam, sandy loam, or sand and ranges from slightly acid to neutral.

Fox series

The Fox series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the lower part. These soils are on glacial outwash plains, terraces, kames, and eskers. They formed in silty and loamy deposits that are underlain by sand and gravel. Slopes range from 0 to 30 percent.

Fox soils are commonly adjacent to Casco, Ionia, and Rodman soils on the landscape. These soils are underlain by sand and gravel. Casco soils have a thinner solum than the Fox soils. Ionia soils are moderately well drained and have mottles in the subsoil. Rodman soils have a thinner solum and do not have an argillic horizon.

Typical pedon of Fox silt loam, 2 to 6 percent slopes, 1,300 feet south and 2,400 feet east of the NW corner of sec. 10, T. 9 N., R. 17 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; neutral; abrupt smooth boundary.
A2—8 to 12 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; neutral; abrupt wavy boundary.
B21t—12 to 22 inches; brown (10YR 5/3) silty clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; medium acid; gradual wavy boundary.
IIB22t—22 to 36 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium subangular blocky structure; firm; thin patchy clay films on faces of peds; neutral; abrupt irregular boundary.
IIC—36 to 60 inches; yellowish brown (10YR 5/4) sand and gravel; single grained; loose; stratified; strong effervescence; moderately alkaline.

The thickness of the solum and depth to sand and gravel outwash range from 24 to 40 inches. The thickness of the silty mantle is as much as 24 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and clay loam. The A2 horizon, if present, has value of 4 or 5 and chroma of 2 or 3. The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is silty clay loam, silt loam, clay loam, or loam and is strongly acid or medium acid. The IIBt horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 4 to 6. It is clay loam, loam, or, less commonly, sandy clay loam and ranges from medium acid to mildly alkaline. Gravel content ranges from 0 to 15 percent. The IIC horizon has value of 5 or 6 and chroma of 4 to 6. Strata of sand and gravel range from one-half inch to several feet in thickness.

Granby Variant

The Granby Variant consists of deep, very poorly drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils are on terraces and in glacial lake basins. They formed in sand that contains a few loamy strata. Slopes are 0 to 2 percent.

Granby Variant soils are commonly near Adrian Variant, Keowns, and Kibbie soils on the landscape. Adrian Variant soils are organic soils that overlie stratified fine sand and silt. Keowns soils are poorly drained loamy soils, and Kibbie soils are somewhat poorly drained loamy soils.

Typical pedon of Granby Variant fine sandy loam, 100 feet south and 750 feet east of the NW corner of sec. 15, T. 9 N., R. 13 E.

Ap—0 to 8 inches; black (10YR 2/1) fine sandy loam; weak medium granular structure; very friable; moderately alkaline; abrupt smooth boundary.
B2g—8 to 11 inches; dark gray (5Y 4/1) loam; weak medium subangular blocky structure; friable; moderately alkaline; abrupt smooth boundary.
B3g—11 to 30 inches; olive gray (5Y 5/2) fine sand; weak medium subangular blocky structure; very friable; slight effervescence; moderately alkaline; clear smooth boundary.
C—30 to 60 inches; light olive brown (2.5Y 5/4) sand; single grained; loose; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 35 inches. The thickness of the loamy layers over sand ranges from 10 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 14 inches.

The Ap or A1 horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 or 3; and chroma of 0 to 2. It is dominantly fine sandy loam, but the range includes sandy loam and loam. The B2g horizon has hue of 5Y or 2.5Y, value of 4 or 5, and chroma of 0 to 1. The B3g and C horizons have hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 0 to 4.

Hochheim series

The Hochheim series consists of deep, well drained, moderately permeable or moderately slowly permeable soils on drumlins and moraines. These soils formed in thin deposits of loess and in the underlying loamy glacial till of high carbonate content. Slopes range from 2 to 30 percent.

Hochheim soils are commonly near Mayville, Nenno, and Theresa soils. Mayville soils are moderately well drained and are thicker over glacial till than the Hochheim soils. Nenno soils are underlain by glacial till similar to that under Hochheim soils but are somewhat poorly drained and are mostly on foot slopes below the Hochheim soils. Theresa soils have a thicker loess mantle and are thicker to unweathered glacial till than the Hochheim soils.

Typical pedon of Hochheim silt loam, 2 to 6 percent slopes, 1,300 feet north and 800 feet west of the SE corner of sec. 36, T. 13 N., R. 17 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; weak coarse and medium granular structure; friable; few dolomite pebbles on soil surface; moderately alkaline; abrupt smooth boundary.

B21t—7 to 11 inches; brown (10YR 4/3) clay loam; moderate medium subangular blocky structure; firm; thin continuous dark brown (10YR 3/3) clay films on faces of peds; few dolomite pebbles; many earthworm casts; mildly alkaline; clear smooth boundary.

B22t—11 to 16 inches; dark brown (10YR 4/3) clay loam; moderate medium subangular blocky structure; firm; few dark brown (10YR 3/3) patchy clay films on faces of peds; about 15 percent gravel; slight effervescence in lower part; mildly alkaline; clear smooth boundary.

C1—16 to 24 inches; brown (10YR 5/3) gravelly loam; weak coarse subangular blocky structure in the upper part; massive in the lower part; friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—24 to 60 inches; pale brown (10YR 6/3) gravelly loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to unweathered glacial till range from 12 to 20 inches. The thickness of the loess mantle ranges from 0 to 10 inches. The thickness of the mollic epipedon ranges from 5 to 8 inches.

The Ap horizon has value and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. In severely eroded soils, this horizon is clay loam. The B2t horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4; it ranges from slightly acid to mildly alkaline. Gravel content ranges from 15 to 30 percent. The C horizon has chroma of 3 or 4. It is gravelly loam, loam, or gravelly sandy loam. Gravel content ranges from 10 to 50 percent. Content of flagstone and other coarse fragments ranges from 0 to 10 percent. The C horizon is very compact in places.

In map unit HoD3, the surface layer is lighter colored than the defined range for the series, but this difference does not alter the use and behavior of the soil.

Houghton series

The Houghton series consists of deep, very poorly drained, moderately rapidly permeable soils in depressions on glacial lake plains and moraines. These soils formed mainly in decomposed sedges and reeds. Slopes are 0 to 2 percent.

Houghton soils are commonly near Adrian Variant, Palms, and Pella soils. Adrian Variant soils are organic soils that are underlain by silt and fine sand at a depth of 16 to 51 inches. Palms soils are organic soils that are underlain by silty clay loam at a depth of 16 to 51 inches. Pella soils formed in silty deposits that are underlain by gravelly loam.

Typical pedon of Houghton muck, 900 feet east and 100 feet north of the SW corner of sec. 18, T. 9 N., R. 13 E.

Oa1—0 to 15 inches; black (N 2/0) broken face and rubbed sapric material, about 5 percent fiber, a trace rubbed; weak coarse granular structure; neutral; gradual smooth boundary.

Oa2—15 to 24 inches; black (N 2/0) broken face and rubbed sapric material, about 5 percent fiber, a trace rubbed; massive parting to thick platy fragments; neutral; abrupt smooth boundary.

Oa3—24 to 30 inches; dark reddish brown (5YR 2/2) broken face and rubbed sapric material, about 15 percent fiber, a trace rubbed; massive; few woody fragments; neutral; clear smooth boundary.

Oa4—30 to 48 inches; black (5YR 2/1) broken face and rubbed sapric material, about 10 percent fiber, none rubbed; massive; neutral; abrupt smooth boundary.

Oa5—48 to 60 inches; dark grayish brown (10YR 4/2) broken face and rubbed sapric material, about 5 percent fiber, none rubbed; common snail shells; massive; mildly alkaline.

The organic layer is more than 51 inches thick. The surface tier has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 3. It is sapric material, but some pedons in uncultivated areas have a thin, 1-inch thick mat of sphagnum moss or undecomposed plant remains on the surface. The subsurface and bottom tiers have hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 2. They are dominantly sapric material, but some pedons have thin layers of hemic or fibric material. Layers of hemic material have a combined thickness of less than 10 inches, and layers of fibric material have a combined thickness of less than 5 inches. The organic materials are mainly from herbaceous plants, but a few woody fragments ranging from one-eighth inch to several inches in diameter are mixed throughout some pedons. Reaction in the organic material is neutral or mildly alkaline. Some pedons have a sandy, loamy, or silty IIC horizon between depths of 51 and 60 inches.

Ionia series

The Ionia series consists of deep, moderately well drained soils that are moderately permeable in the upper part and very rapidly permeable in the lower part. These soils are on glacial outwash terraces. They formed in silty and loamy deposits over sand and gravel outwash. Slopes are 0 to 3 percent.

Ionia soils are commonly near Fox soils. Fox soils formed in similar material but are well drained.

Typical pedon of Ionia silt loam, 0 to 3 percent slopes, 200 feet west and 1,000 feet south of the NE corner of sec. 36, T. 11 N., R. 16 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2—9 to 15 inches; brown (10YR 5/3) silt loam; weak medium platy structure; friable; neutral; clear wavy boundary.

B21t—15 to 32 inches; dark brown (10YR 4/3) silty clay loam; few fine prominent brownish yellow (10YR 6/6) mottles in the lower part; moderate medium subangular blocky structure; continuous clay films on faces of most peds; firm; neutral; clear wavy boundary.

IIB22t—32 to 36 inches; dark brown (10YR 4/3) gravelly clay loam; few fine prominent brownish yellow (10YR 6/6) and few fine faint grayish brown (10YR 5/2) mottles; firm; weak coarse subangular blocky structure; thick discontinuous clay films on faces of most peds; mildly alkaline; clear wavy boundary.

IIC—36 to 60 inches; pale brown (10YR 6/3) sand and gravel; common medium faint grayish brown (10YR 5/2) mottles; single grained; loose; strong effervescence; moderately alkaline.

The thickness of the solum and depth to sand and gravel range from 24 to 40 inches. The thickness of the silty mantle ranges from 0 to 32 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and sandy loam. The A2 horizon, if present, has chroma of 2 or 3. The B2t horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or clay loam and ranges from strongly acid to neutral. The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is gravelly clay loam, gravelly sandy clay loam, gravelly sandy loam, or clay loam and ranges from medium acid to neutral. Gravel content ranges from 0 to 35 percent. The IIC horizon has value of 5 or 6 and chroma of 3 to 5. Strata of sand and gravel range from one-half foot to several feet in thickness.

Juneau series

The Juneau series consists of deep, well drained and moderately well drained, moderately permeable soils on foot slopes of drumlins and ground moraine ridges and in drainageways. These soils formed in silty colluvium and alluvium that underlie older loamy soils. Slopes range from 0 to 6 percent.

Juneau soils are near Lamartine, Mayville, and St. Charles soils on the landscape. Lamartine soils are somewhat poorly drained, have an argillic horizon, and formed partly in loamy till. Mayville soils are moderately well drained, have an argillic horizon, and formed partly in gravelly loam till. St. Charles soils are well drained and moderately well drained, have an argillic horizon, and formed partly in loamy till. Unlike Juneau soils, Lamartine, Mayville, and St. Charles soils do not have the buried soil horizons.

Typical pedon of Juneau silt loam, 0 to 2 percent slopes, 40 feet south and 2,100 feet east of the NW corner of sec. 27, T. 12 N., R. 17 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

C1—6 to 20 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

C2—20 to 24 inches; very dark grayish brown (10YR 3/2) and grayish brown (10YR 5/2) silt loam; weak medium platy structure parting to moderate very fine subangular blocky; friable; thin discontinuous layers of very fine sand; neutral; clear smooth boundary.

A1b—24 to 30 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

B1b—30 to 40 inches; dark brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

B2tb—40 to 54 inches; dark brown (7.5YR 4/2) silty clay loam; few fine faint brown (7.5YR 5/2) and few fine prominent strong brown (7.5YR 5/8) mottles in the lower part; weak thick platy structure parting to moderate fine subangular blocky; friable; few thin patchy clay films on faces of peds; neutral; clear wavy boundary.

IIB3tb—54 to 60 inches; brown (7.5YR 4/4) clay loam; weak medium subangular blocky structure; firm; dark brown (7.5YR 3/2) thin patchy clay films on faces of peds; few small pebbles and coarse sand grains; slightly acid; clear smooth boundary.

The thickness of the silty colluvium or alluvium over the older buried soil ranges from 20 to 36 inches. Reaction ranges from medium acid to mildly alkaline in all subhorizons.

The Ap or A1 horizon and the C horizon have value of 3 to 6 and chroma of 2 or 3. The Ab, B1b, and B2tb horizons have hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. They are silt loam or silty clay loam. The IIB3t horizon is similar in color to the B2tb horizon. It is clay loam, silt loam, or silty clay loam.

Keowns series

The Keowns series consists of deep, poorly drained, moderately permeable soils on stream terraces and glacial lake plains. These soils formed in loamy material that is underlain by lacustrine silt loam, sand, and fine sand. Slopes are 0 to 2 percent.

Keowns soils are commonly near Kibbie and Sisson soils. Keowns soils are generally lower on the landscape than Sisson and Kibbie soils. Kibbie soils are somewhat poorly drained and have a finer textured argillic horizon. Sisson soils are well drained, have a finer textured argillic horizon, and have an ochric epipedon.

Typical pedon of Keowns silt loam, 100 feet south and 1,800 feet east of the NW corner of sec. 30, T. 9 N., R. 17 E.

Ap—0 to 9 inches; black (10YR 2/1) silt loam; moderate medium subangular blocky structure parting to moderate medium granular; friable; mildly alkaline; abrupt smooth boundary.

A2g—9 to 16 inches; light brownish gray (2.5Y 6/2) silt loam; few fine prominent olive yellow (2.5Y 6/6) mottles; weak medium platy structure parting to weak very fine subangular blocky; friable; mildly alkaline; gradual wavy boundary.

B21g—16 to 26 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; mildly alkaline; clear smooth boundary.

B22g—26 to 32 inches; stratified light brownish gray (2.5Y 6/2) silt loam and brown (10YR 5/3) fine sand; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very friable; slight effervescence; moderately alkaline; gradual wavy boundary.

C1—32 to 40 inches; brown (10YR 5/3) fine sand with thin strata of light brownish gray (2.5Y 6/2) silt loam; many fine faint and distinct yellowish brown (10YR 5/4) mottles; few streaks of very dark brown (10YR 2/2); massive; friable; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—40 to 60 inches; yellowish brown (10YR 5/6) sand with thin layers of light brownish gray (2.5Y 6/2) silt loam; many medium and fine strong brown (7.5Y 5/6), yellowish brown (10YR 5/4), and grayish brown (10YR 5/2) mottles; massive; stratified; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 15 to 34 inches.

The A1 or Ap horizon has value of 2 or 3 and chroma of 1. It is dominantly silt loam, but the range includes loam and fine sandy loam. The A2 horizon has hue of 10YR or 2.5Y, value of 4 to 5, and chroma of 1 or 2. The B2g horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 or 2. It is silt loam, sandy loam, or very fine sandy loam and is neutral to moderately alkaline. The C horizon is stratified silt loam, sand, and fine sand but includes layers of silt, fine sandy loam, or very fine sandy loam in some pedons.

Kibbie series

The Kibbie series consists of deep, somewhat poorly drained, moderately permeable soils on stream terraces and in glacial lake plains. These soils formed in loamy and silty lacustrine or eolian deposits. Slope ranges from 0 to 6 percent.

Kibbie soils are commonly near Keowns, Pella, and Sisson soils on the landscape. Keowns soils are poorly drained and do not have an argillic horizon. Pella soils are poorly drained silty soils that have a mollic epipedon and are underlain by glacial drift. Sisson soils formed in similar material and are well drained but have a thinner or lighter colored surface layer.

Typical pedon of Kibbie loam, 2 to 6 percent slopes, 1,200 feet west and 2,500 feet north of the SE corner of sec. 3, T. 9 N., R. 16 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

A2—8 to 14 inches; brown (10YR 5/3) loam; moderate thin platy structure; friable; neutral; abrupt wavy boundary.

B21t—14 to 23 inches; dark brown (10YR 4/3) loam; many medium prominent yellowish brown (10YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; thin clay films on faces of peds; firm; neutral; clear wavy boundary.

IIB22t—23 to 35 inches; dark brown (10YR 4/3) sandy clay loam; common medium faint brown (10YR 5/3) and grayish brown (10YR 5/2) and few medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; thin clay films on faces of peds and in root channels; few thin layers of fine sand and silt; neutral; clear wavy boundary.

IIIC1—35 to 41 inches; grayish brown (10YR 5/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; very firm; neutral; gradual wavy boundary.

IVC2—41 to 60 inches; dark grayish brown (10YR 4/2) fine sand; common fine distinct dark yellowish brown (10YR 4/4) mottles; single grained; loose; few thin layers of silt; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 24 to 42 inches.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam and fine sandy loam. The A2 horizon has value of 5 or 6 and chroma of 2 or 3. The B2t and IIB2t

horizons have value of 4 or 5 and chroma of 3 to 6. They are loam, silt loam, clay loam, or sandy clay loam and range from medium acid to neutral. The C horizon has value of 4 to 6 and chroma of 2 to 4. It is stratified silt loam and very fine sand with strata of silt, loam, fine sandy loam, or loamy fine sand in some pedons.

Kidder series

The Kidder series consists of deep, well drained, moderately permeable soils on ground moraines, drumlins, and moraines. These soils formed in loamy material over gravelly sandy loam glacial till of moderate carbonate content. Slopes range from 2 to 30 percent.

Kidder soils are commonly near Miami, Pella, and St. Charles soils on the landscape. Kidder soils have a coarser textured C horizon than the Miami soils. Pella soils have a mollic epipedon, are more silty than Kidder soils, and are poorly drained. St. Charles soils are thicker over glacial till.

Typical pedon of Kidder loam, 2 to 6 percent slopes, 2,200 feet north and 100 feet east of the SW corner of sec. 33, T. 10 N., R. 17 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A2—8 to 13 inches; brown (10YR 5/3) loam; weak medium platy structure; friable; slightly acid; clear wavy boundary.
B2t—13 to 30 inches; brown (10YR 5/3) sandy clay loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; neutral; gradual wavy boundary.
B3—30 to 36 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; firm; slightly acid; gradual wavy boundary.
C—36 to 60 inches; yellowish brown (10YR 5/4) gravelly sandy loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 24 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam and fine sandy loam. The A2 horizon, if present, has value of 4 or 5 and chroma of 2 or 3. The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is sandy clay loam, clay loam, or loam and ranges from medium acid to mildly alkaline. Gravel content ranges from 0 to 15 percent and includes as much as 5 percent cobblestones and stones. The C horizon has value of 5 or 6 and chroma of 3 to 5. It is gravelly sandy loam or sandy loam. Gravel content ranges from 5 to 35 percent and includes 3 to 10 percent cobblestones and stones.

Knowles series

The Knowles series consists of moderately deep, well drained, moderately permeable soils on ground moraines. These soils formed mainly in loess and in the underlying loamy glacial till, which is underlain by dolomite bedrock. Slopes range from 0 to 12 percent.

Knowles soils are commonly near Dodge, Lomira, and St. Charles soils on the landscape. These soils are underlain by glacial till and do not have a dolomite substratum.

Typical pedon of Knowles silt loam, 2 to 6 percent slopes, 2,650 feet west and 1,300 feet north of the SE corner of sec. 18, T. 13 N., R. 17 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; neutral; abrupt smooth boundary.
A2—10 to 12 inches; brown (10YR 5/3) silt loam; moderate thin platy structure; peds have light gray (10YR 7/2) coatings; friable; neutral; abrupt wavy boundary.
B21t—12 to 20 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; light gray (10YR 7/2) coatings on peds; firm; thin patchy clay films on faces of peds; neutral; clear smooth boundary.
B22t—20 to 23 inches; dark brown (10YR 4/3) silty clay loam; strong medium subangular blocky structure; very firm; patchy dark brown (7.5YR 3/2) clay films on faces of peds; clay films are more pronounced in the lower part of the horizon; slightly acid; clear smooth boundary.
IIB23t—23 to 25 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; dark brown (7.5YR 3/2) clay films on faces of peds; few small pebbles; slightly acid; abrupt smooth boundary.
IIIR—25 to 60 inches; light brownish gray (2.5Y 6/2) creviced dolomite.

The thickness of the solum and depth to dolomite range from 20 to 40 inches. The thickness of loess ranges from 18 to 36 inches, and the thickness of glacial till ranges from 2 to 6 inches.

The Ap horizon has value of 2 to 4 and chroma of 2 or 3. The A2 horizon, if present, has value of 4 or 5 and chroma of 2 to 4. The B2t horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silt loam and ranges from medium acid to neutral. 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, or, less commonly, sandy clay loam. Reaction ranges from slightly acid to moderately alkaline. Gravel content ranges from 5 to 15 percent and includes as much as 5 percent dolomite flagstones. The IIIR horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 2 or 3. In most places, it is hard and unweathered; in other places, it is

weathered and creviced, and soil material from the IIB2t horizon fills these crevices.

Knowles Variant

The Knowles Variant consists of moderately deep, somewhat poorly drained, moderately permeable soils on ground moraines. These soils formed mainly in loess and in the underlying glacial till, which is underlain by dolomite bedrock. Slopes range from 0 to 6 percent.

Knowles Variant soils are near Knowles soils on the landscape. Knowles soils do not have mottles in the subsoil and have a thinner or lighter colored surface layer.

Typical pedon of Knowles Variant silt loam, 0 to 2 percent slopes, 1,320 feet south and 2,000 feet west of the NE corner of sec. 36, T. 13 N., R. 16 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium granular structure; friable; mildly alkaline; abrupt smooth boundary.

A2—9 to 13 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure; friable; few fine distinct yellowish brown (10YR 5/6) mottles; mildly alkaline; gradual wavy boundary.

B21t—13 to 27 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; few fine faint grayish brown (10YR 5/2) mottles; thin patchy clay films on faces of peds; medium acid; gradual wavy boundary.

IIB22t—27 to 30 inches; dark brown (10YR 4/3) clay loam; many medium prominent strong brown (7.5YR 5/6) and few medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; few dolomite pebbles and cobblestones; moderately alkaline; abrupt smooth boundary.

IIIR—30 to 60 inches; light brownish gray (2.5Y 6/2) creviced dolomite.

The thickness of the solum and depth to dolomite range from 20 to 40 inches. The thickness of the loess ranges from 20 to 40 inches.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 5 or 6 and chroma of 3 or 4. The B2t and IIB2t horizons have value of 4 or 5 and chroma of 3 or 4. Reaction in the B2t horizon ranges from medium acid to neutral. Gravel content in the IIB2t horizon ranges from 5 to 15 percent and includes as much as 5 percent dolomite flagstones. The IIIR horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 2 or 3. In most places, the dolomite is hard and unweathered; in other places, it is weathered and creviced, and soil material from the IIB2t horizon fills these crevices.

Lamartine series

The Lamartine series consists of deep, somewhat poorly drained, moderately permeable soils on foot slopes of ground moraines and drumlins and on the crests of wide drumlins. These soils formed in loess and in the underlying loamy glacial till, which has a moderate to high carbonate content. Slopes range from 0 to 6 percent.

Lamartine soils are commonly near Dodge, Mayville, Pella, and Theresa soils on the landscape. Dodge and Theresa soils are well drained, and Mayville soils are moderately well drained. These soils have a surface layer that is lighter colored or thinner than that of the Lamartine soils. Pella soils are poorly drained and have a mollic epipedon.

Typical pedon of Lamartine silt loam, 0 to 2 percent slopes, 1,600 feet south and 1,800 feet west of the NE corner of sec. 13, T. 11 N., R. 16 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium and fine granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 11 inches; grayish brown (10YR 5/2) silt loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to moderate medium granular; friable; many worm casts; neutral; gradual wavy boundary.

B1—11 to 17 inches; dark brown (10YR 4/3) silt loam; common medium prominent yellowish brown (10YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; slightly acid; clear wavy boundary.

B21t—17 to 25 inches; dark yellowish brown (10YR 4/4) silty clay loam; many fine distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; moderate medium subangular and angular blocky structure parting to moderate fine angular blocky; firm; continuous clay films with dark brown (7.5YR 3/2) organic stains; slightly acid; clear wavy boundary.

IIB22t—25 to 35 inches; brown (10YR 5/3) clay loam; many medium prominent yellowish brown (10YR 5/8) and many medium faint light brownish gray (10YR 6/2) mottles; moderate medium subangular and angular blocky structure; firm; thick patchy clay films; mildly alkaline; clear wavy boundary.

IIC—35 to 60 inches; yellowish brown (10YR 5/4) loam; many medium prominent yellowish brown (10YR 5/8) and many medium distinct grayish brown (10YR 5/2) mottles; massive; friable; many pebbles, stones, and cobblestones; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 24 to 40 inches. The thickness of the loess ranges from 20 to 36 inches.

The Ap or 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 B1 and B2t horizons have value of 4 or 5 and chroma of 3 to 6. They are silt loam or silty clay loam and range from slightly acid to mildly alkaline. The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or loam and is neutral or mildly alkaline. Gravel content ranges from 0 to 10 percent. The IIC horizon has value of 5 to 7 and chroma of 3 or 4. It is loam or sandy loam and, less commonly, gravelly sandy loam. Gravel content ranges from 5 to 25 percent.

LeRoy series

The LeRoy series consists of deep, well drained, moderately permeable soils on ground moraines, moraine knolls and ridges, and drumlins. These soils formed in loess and in the underlying loamy glacial till, which contains large amounts of finely ground dolomite and dolomite gravel, flagstones, and other coarse fragments. Slopes range from 2 to 30 percent.

LeRoy soils are commonly near Lomira and St. Charles soils on the landscape. Lomira and St. Charles soils have a thicker silty mantle and solum. The glacial till under St. Charles soils contains less dolomite.

Typical pedon of LeRoy silt loam, 6 to 12 percent slopes, eroded, 1,000 feet north and 200 feet east of the SW corner of sec. 27, T. 13 N., R. 16 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; neutral; abrupt smooth boundary.

B21t—9 to 14 inches; dark brown (10YR 4/3) silty clay loam; moderate fine and medium subangular blocky structure; firm; few thin clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—14 to 19 inches; dark brown (10YR 4/3) silty clay loam that contains a moderate amount of fine sand; strong medium subangular blocky structure; firm; few very dark brown (10YR 2/2) coatings and clay films on peds; fine chert fragments near the lower boundary of the horizon; strongly acid; clear wavy boundary.

IIB23t—19 to 22 inches; dark brown (10YR 4/3) clay loam; weak coarse subangular blocky structure; firm; few thick very dark brown (10YR 2/2) coatings and clay films on faces of peds; continuous thick coatings around decomposed dolomite pebbles; slight effervescence; moderately alkaline; clear wavy boundary.

IIC—22 to 60 inches; brown (10YR 5/3) gravelly loam; massive; friable; many channery fragments; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 12 to 24 inches. The thickness of the loess ranges from 10 to 18 inches.

The Ap horizon has value of 4 and chroma of 2 to 4. The B2t horizon has value and chroma of 3 to 5 and is strongly acid or medium acid. The IIB2t horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4. It is clay loam, loam, or sandy clay loam. Gravel content ranges from 5 to 15 percent. The IIC horizon has value of 5 or 6 and chroma of 3 or 4. It is gravelly loam, gravelly sandy loam, or very gravelly sandy loam. Gravel content ranges from 15 to about 50 percent. Dolomite fragments that are more than 3 inches in length make up 3 to 10 percent of the volume. The calcium carbonate equivalent ranges from 60 to 90 percent.

Lomira series

The Lomira series consists of deep, well drained, moderately permeable soils on ground moraines. These soils formed in loess and in the underlying loamy glacial till, which has a high carbonate content and contains large amounts of finely ground dolomite and dolomite pebbles, fragments, and flagstones. Slopes range from 2 to 12 percent.

Lomira soils are commonly near LeRoy and St. Charles soils on the landscape. LeRoy soils have a thinner silty mantle and solum. St. Charles soils have a thicker silty mantle and solum and are underlain by glacial till that contains less dolomite.

Typical pedon of Lomira silt loam, 2 to 6 percent slopes, 400 feet south and 1,500 feet west of the NE corner of sec. 10, T. 13 N., R. 16 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 10 inches; brown (10YR 4/3) silt loam; weak thick platy structure; friable; pale brown (10YR 6/3) silt coatings; some mixing with material from the Ap horizon by worm and animal activity; slightly acid; clear smooth boundary.

B1—10 to 14 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; pale brown (10YR 6/3) silt coatings on faces of peds; medium acid; clear wavy boundary.

B21t—14 to 20 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; very pale brown (10YR 7/3) silt coatings on peds; few thin patchy clay films on faces of peds; strongly acid; gradual wavy boundary.

B22t—20 to 31 inches; dark brown (10YR 4/3) silty clay loam; strong medium subangular blocky structure; firm; dark brown (7.5YR 3/2) thick continuous clay films; very strongly acid; clear wavy boundary.

IIB3t—31 to 34 inches; dark brown (10YR 4/3) and brown (10YR 5/3) sandy clay loam containing many dolomite fragments, sand, and gravel; weak coarse subangular blocky structure; friable; very dark grayish brown (10YR 3/2) patchy clay films on faces of peds; neutral; abrupt wavy boundary.

IIC—34 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; large amounts of

finely ground dolomite, dolomite fragments, and flagstones; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 24 to 40 inches. The thickness of the loess ranges from 20 to 36 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. The A2 horizon, if present, has value of 4 or 5 and chroma of 2 or 3. The B1 horizon has value of 4 and chroma of 3 or 4. The B2t horizon has value of 4 and chroma of 3 or 4 and ranges from strongly acid to slightly acid. The IIB3t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy clay loam, clay loam, or loam and ranges from neutral to moderately alkaline. Gravel content ranges from 5 to 15 percent. The IIC horizon has value of 5 or 6 and chroma of 3 or 4. It is gravelly loam, gravelly sandy loam, or very gravelly sandy loam. Gravel content ranges from 15 to about 50 percent. Dolomite fragments that are more than 3 inches in length make up 3 to 10 percent of the volume. The calcium carbonate equivalent ranges from 60 to 70 percent.

Markesan series

The Markesan series consists of deep, well drained, moderately permeable soils on moraines and drumlins. These soils formed in loess that is underlain by loamy glacial till, which has a high carbonate content and contains large amounts of finely ground dolomite and dolomite gravel, flagstones, and other coarse fragments. Slope ranges from 2 to 12 percent.

Markesan soils are near Mendota and Plano soils on the landscape. Mendota and Plano soils are thicker over till than the Markesan soils. The glacial till under the Plano soils contains less dolomite than that under Markesan soils.

Typical pedon of Markesan silt loam, 2 to 6 percent slopes, 1,000 feet south and 1,000 feet west of the NE corner of sec. 31, T. 13 N., R. 14 E.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam; moderate medium granular structure; friable; mildly alkaline; abrupt smooth boundary.

B1—7 to 9 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; neutral; clear smooth boundary.

B21t—9 to 15 inches; dark brown (7.5YR 3/2) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous clay films on faces of peds; few chert fragments; slightly acid; clear smooth boundary.

B22t—15 to 18 inches; dark brown (7.5YR 3/2) silty clay loam that contains a moderate amount of fine sand; moderate medium subangular blocky structure; firm; thin continuous clay films on faces of peds; common chert fragments; neutral; abrupt wavy boundary.

IIC1—18 to 22 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; many angular dolomite fragments; violent effervescence; moderately alkaline; gradual smooth boundary.

IIC2—22 to 60 inches; brown (10YR 5/3) gravelly loam; massive; firm; common dolomite channery fragments and flagstones; violent effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 12 to 24 inches. The thickness of the loess ranges from 10 to 18 inches. The thickness of the mollic epipedon ranges from 7 to 10 inches.

The Ap or A1 horizon has value of 1 to 3 and chroma of 2 or 3. The B1 horizon has value and chroma of 3 to 5. The B21t and B22t horizons have hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 5. Reaction in the B21t horizon is medium acid or slightly acid. The B22t horizon is silty clay loam, loam, or sandy clay loam and ranges from neutral to moderately alkaline. Gravel content ranges from 5 to 15 percent. The IIC horizon has value of 5 or 6 and chroma of 3 or 4. It is gravelly loam, gravelly sandy loam, or very gravelly sandy loam. Gravel content ranges from 15 to about 50 percent. Dolomite fragments that are more than 3 inches in length make up 3 to 10 percent of the volume. The calcium carbonate equivalent ranges from 60 to 90 percent.

Mayville series

The Mayville series consists of deep, moderately well drained, moderately permeable soils on foot slopes of ground moraines and drumlins and on the crests of wide drumlins. These soils formed in loess and in the underlying loamy glacial till, which has a moderate to high carbonate content. Slopes range from 0 to 12 percent.

Mayville soils are commonly near Dodge, Lamartine, Pella, and Theresa soils on the landscape. Dodge soils formed in similar material but are well drained. Lamartine soils formed in similar material but have a thicker, darker colored surface layer and are somewhat poorly drained. Pella soils have a mollic epipedon and are poorly drained. Theresa soils are well drained and are underlain by glacial till that contains more carbonates.

Typical pedon of Mayville silt loam, 2 to 6 percent slopes, 2,300 feet north and 150 feet east of the SW corner of sec. 13, T. 12 N., R. 17 E.

A1—0 to 3 inches; very dark gray (10YR 3/1) silt loam; moderate fine granular structure; friable; neutral; clear wavy boundary.

A2—3 to 11 inches; brown (10YR 5/3) silt loam; weak medium platy structure; friable; slightly acid; clear wavy boundary.

B1—11 to 14 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; slightly acid; clear wavy boundary.

B21t—14 to 25 inches; brown (10YR 5/3) silty clay loam; a few medium faint yellowish brown (10YR 5/4) mottles in the lower part; moderate medium subangular blocky structure; firm; clay films on faces of peds; slightly acid; clear wavy boundary.
IIB22t—25 to 31 inches; dark brown (10YR 4/3) clay loam; few medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; clay films on faces of peds; slightly acid; gradual wavy boundary.
IIB3—31 to 36 inches; brown (10YR 5/3) gravelly loam; few medium prominent yellowish brown (10YR 5/6) and few medium faint grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; patchy clay films on faces of peds; neutral; clear wavy boundary.
IIC—36 to 60 inches; brown (10YR 5/3) gravelly loam; few medium prominent brownish yellow (10YR 6/8) and few medium faint grayish brown (10YR 5/2) mottles; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 30 to 42 inches. The thickness of the loess mantle ranges from 24 to 36 inches.

The A1 or Ap horizon has value of 3 to 5 and chroma of 1 to 3. The A2 horizon, if present, has value of 4 or 5 and chroma of 2 or 3. The B1 horizon has value of 4 or 5 and chroma of 3 or 4. The B2t horizon has value of 4 or 5 and chroma of 3 or 4. It is silty 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. It is clay loam or silty clay loam. Reaction in the B2t and IIB2t horizons ranges from strongly acid to slightly acid. The IIB3 horizon is similar in color to the IIB2t horizon. It is gravelly loam or clay loam and is slightly acid or neutral. The IIC horizon has value and chroma of 4 or 5. It is gravelly loam, loam, or gravelly sandy loam. Gravel content ranges from 10 to 25 percent. There is 0 to 5 percent cobblestones and stones.

McHenry series

The McHenry series consists of deep, well drained, moderately permeable soils on drumlins and ground moraines. These soils formed in loess and in the underlying glacial till. Slopes range from 2 to 18 percent.

McHenry soils are commonly near Dodge, Pella, and St. Charles soils. Dodge soils have thicker silty layers and commonly have less sand in the upper part of the argillic horizon than the McHenry soils. Pella soils are poorly drained and have a mollic epipedon. St. Charles soils have thicker silty layers than the McHenry soils.

Typical pedon of McHenry silt loam, 2 to 6 percent slopes, 1,650 feet south and 1,150 feet west of the NE corner of sec. 24, T. 11 N., R. 17 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; medium acid; abrupt smooth boundary.
A2—9 to 12 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; medium acid; clear wavy boundary.
B21t—12 to 20 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; firm; few thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.
IIB22t—20 to 38 inches; dark brown (7.5YR 4/4) clay loam in the upper part and brown (7.5YR 5/4) sandy clay loam in the lower part; moderate medium subangular blocky structure; firm; few thin patchy clay films on faces of peds; medium acid; clear wavy boundary.
IIC—38 to 60 inches; light yellowish brown (10YR 6/4) gravelly sandy loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 30 to 45 inches. The thickness of the loess mantle ranges from 12 to 24 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The A2 horizon, if present, has value of 4 or 5 and chroma of 2 or 3. The B2t horizon has value of 4 to 6 and chroma of 3 to 6. It is silty clay loam or silt loam. The IIB2t horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is clay loam or sandy clay loam. Reaction in the B2t and IIB2t horizons ranges from strongly acid to mildly alkaline. The IIC horizon has value of 5 or 6 and chroma of 3 or 4. It is gravelly sandy loam or sandy loam. Gravel content ranges from 5 to 25 percent. There is 0 to 5 percent cobblestones and stones.

Mendota series

The Mendota series consists of deep, well drained, moderately permeable soils on ground moraines and drumlins. These soils formed in loess and in the underlying loamy glacial till, which has a high carbonate content and large amounts of finely ground dolomite and dolomite pebbles, fragments, and flagstones. Slopes range from 2 to 12 percent.

Mendota soils are commonly near Elburn, Markesan, and Plano soils on the landscape. Elburn soils have á thicker silty mantle than Mendota soils and are somewhat poorly drained. Markesan soils and the Mendota soil formed in similar material, but Markesan soils are shallower to the underlying glacial till. Plano soils are thicker over the underlying till than the Mendota soils and are underlain by glacial till that contains less dolomite.

Typical pedon of Mendota silt loam, 2 to 6 percent slopes, 460 feet east and 200 feet north of the SW corner of sec. 21, T. 13 N., R. 14 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; moderate fine granular structure; friable; neutral; abrupt smooth boundary.
A12—8 to 10 inches; dark brown (10YR 3/3) silt loam; weak thick platy structure parting to moderate fine subangular blocky; friable; strongly acid; clear wavy boundary.
B1—10 to 18 inches; dark yellowish brown (10YR 3/4) silt loam; weak medium prismatic structure parting to moderate medium subangular blocky; friable; dark brown (7.5YR 4/2) coatings on faces of peds; strongly acid; clear wavy boundary.
B21t—18 to 29 inches; dark brown (10YR 4/3) silty clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; dark brown (7.5YR 4/2) thin patchy clay films on faces of peds; strongly acid; clear smooth boundary.
IIB22t—29 to 34 inches; dark brown (10YR 4/3) clay loam; weak coarse prismatic structure parting to moderate coarse subangular blocky; firm; thick continuous dark brown (7.5YR 3/2) clay films on faces of peds; neutral; abrupt wavy boundary.
IIC1—34 to 45 inches; brown (10YR 5/3) gravelly loam; massive; friable; many angular dolomite fragments; violent effervescence; calcium carbonate equivalent 70 percent; moderately alkaline; gradual smooth boundary.
IIC2—45 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; compact in places; about 35 percent angular dolomitic fragments; large quantities of finely ground dolomite; violent effervescence; calcium carbonate equivalent 80 percent; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 24 to 40 inches. The thickness of the loess ranges from 20 to 36 inches. The thickness of the mollic epipedon ranges from 10 to 14 inches.

The Ap and A1 horizons have value of 2 or 3 and chroma of 1 to 3. The B1 horizon has value and chroma of 3 or 4. The B2t horizon has value of 4 and chroma of 3 or 4 and ranges from strongly acid to slightly acid. The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, sandy clay loam, or loam and ranges from neutral to moderately alkaline. Gravel content ranges from 5 to 15 percent. The IIC horizon has value of 5 or 6 and chroma of 3 or 4. It is gravelly loam, gravelly sandy loam, or very gravelly sandy loam. Gravel content ranges from 15 to about 50 percent. Dolomite fragments that are more than 3 inches in length make up 3 to 10 percent of the volume. The calcium carbonate equivalent ranges from 60 to 90 percent.

Miami series

The Miami series consists of deep, well drained, moderately permeable or moderately slowly permeable soils on moraines and drumlins. These soils formed in thin loess and in the underlying loamy glacial till. Slopes range from 2 to 30 percent.

Miami soils are commonly near Dodge and St. Charles soils on the landscape. Dodge and St. Charles soils have thicker loess layers, and St. Charles soils have a thicker solum than the Miami soils.

Typical pedon of Miami silt loam, 2 to 6 percent slopes, 2,600 feet south and 2,600 feet east of the NW corner of sec. 5, T. 10 N., R. 17 E.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable; neutral; abrupt wavy boundary.
A2—6 to 12 inches; brown (10YR 5/3) loam; weak medium platy structure parting to weak very fine subangular blocky; friable; few fine pebbles; slightly acid; clear wavy boundary.
B21t—12 to 20 inches; brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; thick continuous clay films on faces of peds; about 5 percent fine gravel and few coarse sand grains; slightly acid; clear wavy boundary.
B22t—20 to 28 inches; brown (7.5YR 4/4) sandy clay loam; weak medium subangular blocky structure; firm; thin clay films on faces of peds; about 5 percent fine gravel; neutral; clear wavy boundary.
B3—28 to 32 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; about 8 percent fine gravel; slight effervescence; mildly alkaline; gradual wavy boundary.
C—32 to 60 inches; light yellowish brown (10YR 6/4) sandy loam; massive; about 8 percent fine gravel and 18 percent clay; slight effervescence; mildly alkaline.

The thickness of the solum and depth to unweathered glacial till range from 24 to 40 inches.

The A1 or Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. The A2 horizon, if present, has value of 4 to 6 and chroma of 3 or 4. The B2t horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, silty clay loam, or sandy clay loam and ranges from medium acid to neutral. The B3 horizon is similar in color to the B2t horizon. It is fine sandy loam, sandy loam, or loam. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is sandy loam, loam, or, less commonly, clay loam and is mildly alkaline or moderately alkaline. Gravel content ranges from 2 to 10 percent. Content of coarse fragments that are more than 3 inches in diameter ranges from 0 to 3 percent.

Neda series

The Neda series consists of deep, moderately well drained, moderately slowly permeable soils on ground

moraines, terraces, and drumlins. These soils formed in silty deposits and in the underlying loamy glacial drift that derived mainly from shale and dolomite. Slopes range from 2 to 30 percent.

Neda soils are commonly near Ashippun, Hochheim, and Neda Variant soils. Ashippun soils and Neda soils formed in similar material, but the Ashippun soils are somewhat poorly drained. Hochheim soils are well drained and are underlain by gravelly loam till. Neda Variant soils contain more clay in the subsoil than the Neda soils and have a lighter colored surface layer.

Typical pedon of Neda silt loam, 2 to 6 percent slopes, 1,900 feet north and 400 feet east of the SW corner of sec. 16, T. 11 N., R. 16 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium and fine granular structure; friable; mildly alkaline; abrupt smooth boundary.

A2—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium platy structure; friable; mildly alkaline; clear smooth boundary.

B21t—11 to 16 inches; dark brown (10YR 4/3) silty clay loam; weak medium prismatic structure parting to strong fine and medium subangular blocky; firm; dark brown (10YR 3/3) thick patchy clay films; very pale brown (10YR 7/3) silt coatings on surfaces of peds in upper part of horizon; higher sand content in the lower part; neutral; clear wavy boundary.

IIB22t—16 to 21 inches; dark brown (10YR 4/3) shaly clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to strong fine and medium subangular blocky; firm; very dark grayish brown (10YR 3/2) thick patchy clay films on surfaces of peds; 16 percent, by volume, small shale fragments; mildly alkaline; clear wavy boundary.

IIB3t—21 to 25 inches; dark brown (10YR 4/3) shaly loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; common thick very dark gray (10YR 3/1) clay films on faces of peds and in pores; 18 percent, by volume, shale fragments; mildly alkaline; clear irregular boundary.

IIC—25 to 60 inches; pale brown (10YR 6/3) and light gray (10YR 7/2) shaly loam; about 20 percent, by volume, gravel and shale fragments; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 20 to 40 inches. The thickness of the silty material ranges from 10 to 20 inches.

The Ap horizon has value and chroma of 2 or 3. The A2 horizon, if present, has value of 2 to 4 and chroma of 2 or 3. The B2t horizon has value of 4 and chroma of 3 or 4. It is silty clay loam or silt loam and is neutral or mildly alkaline. The IIB2t and IIB3t horizons have hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. They are shaly clay loam, clay loam, shaly loam, or loam and are neutral or mildly alkaline. The IIC horizon is shaly loam or loam. Gravel content in the IIBt horizon and in the IIC horizon ranges from 5 to 25 percent. Content of coarse fragments that are more than 3 inches in diameter ranges from 5 to 10 percent.

Neda Variant

The Neda Variant consists of moderately deep, moderately well drained, slowly permeable soils on ground moraines, drumlins, and terraces. These soils formed in silty and clayey glacial drift and in residuum of shale. Slopes range from 2 to 18 percent.

Neda Variant soils are commonly near Ashippun, Hochheim, and Neda soils. Ashippun soils contain less clay in the subsoil and substratum than the Neda Variant, have a darker colored surface layer, and are somewhat poorly drained. Hochheim soils are well drained and are underlain by gravelly loam till. Neda soils do not have shale bedrock.

Typical pedon of Neda Variant silt loam, 2 to 6 percent slopes, 2,600 feet north and 1,300 feet west of the SE corner of sec. 18, T. 13 N., R. 16 E.

Ap—0 to 9 inches; dark gray (10YR 4/1) silt loam; moderate fine granular structure; friable; mildly alkaline; abrupt smooth boundary.

A2—9 to 12 inches; brown (10YR 5/3) silt loam; weak thick platy structure parting to weak fine subangular blocky; friable; mildly alkaline; clear wavy boundary.

B2t—12 to 21 inches; brown (10YR 4/3) silty clay; common medium faint olive brown (2.5Y 4/4) mottles; strong fine and medium angular blocky structure; very firm; very dark gray (10YR 3/1) thick patchy clay coatings on faces of peds and in pores; mildly alkaline; abrupt wavy boundary.

C—21 to 25 inches; grayish brown (2.5Y 5/2) silt loam and very dark gray (10YR 3/1) silty clay; stratified; weak thick platy structure parting to angular fragments; firm; slight effervescence; moderately alkaline; abrupt smooth boundary.

Cr—25 to 60 inches; grayish brown (2.5Y 5/2) shale; weak thick platy structure; very firm; many dolomitic pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 30 inches, and depth to shale ranges from 20 to 36 inches.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The A2 horizon, if present, has value of 2 to 5 and chroma of 2 or 3. The B2t horizon has value of 4 and chroma of 3 or 4. The C horizon has hue of 2.5Y or 10YR, value of 3 to 5, and chroma of 1 or 2. The Cr horizon has value of 4 or 5 and chroma of 2 to 4.

Nenno series

The Nenno series consists of deep, somewhat poorly drained, moderately permeable or moderately slowly permeable soils on foot slopes and crests of wide drumlins and on foot slopes of ground moraines. These soils formed in thin loess and in the underlying glacial till, which has a high carbonate content. Slopes range from 0 to 6 percent.

Nenno soils are commonly near Hochheim, Mayville, and Theresa soils. Hochheim soils and the Nenno soils formed in similar material, but Hochheim soils are well drained and are on upper convex slopes. Mayville soils are moderately well drained and are underlain by till that has a lower carbonate content. Theresa soils and Nenno soils are underlain by similar glacial till, but Theresa soils have an ochric epipedon and a thicker silty mantle and are well drained.

Typical pedon of Nenno silt loam, 0 to 2 percent slopes, 1,000 feet north and 2,200 feet west of the SE corner of sec. 5, T. 12 N., R. 17 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium granular structure; friable; mildly alkaline; abrupt smooth boundary.
A2—8 to 10 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium subangular blocky structure; friable; mildly alkaline; clear smooth boundary.
B21t—10 to 15 inches; dark brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; firm; very dark grayish brown (10YR 3/2) thick patchy clay films on faces of peds; few small pebbles; mildly alkaline; clear smooth boundary.
B22t—15 to 21 inches; brown (10YR 5/3) clay loam; many medium distinct yellowish brown (10YR 5/6) and many medium faint grayish brown (10YR 5/2) mottles in the interior of peds; moderate medium subangular blocky structure; firm; thick patchy clay films on faces of peds; mildly alkaline; abrupt wavy boundary.
C—21 to 60 inches; light yellowish brown (10YR 6/4) gravelly sandy loam; few coarse fragments as much as 3 inches in diameter; many medium distinct brownish yellow (10YR 6/6) and light brownish gray (10YR 6/2) mottles; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 12 to 24 inches. The thickness of the loess mantle ranges from 0 to 12 inches. The thickness of the mollic epipedon ranges from 6 to 10 inches.

The Ap horizon has value of 1 to 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The B2t horizon has hue of 10YR or 7.5YR, value of 3 or 5, and chroma of 3 or 4. It is clay loam, loam, or silty clay loam and is neutral or mildly alkaline. Gravel content ranges from 0 to about 25 percent. The C horizon has hue of 10YR or 2.5Y, value of 4 or 6, and chroma of 3 or 4. It is gravelly sandy loam, gravelly loam, or loam. Gravel content ranges from 10 to 50 percent. Content of flagstones and other coarse fragments ranges from 0 to 10 percent.

Otter series

The Otter series consists of deep, poorly drained, moderately permeable soils on stream terraces and flood plains. These soils formed in silty alluvium. Slopes are 0 to 2 percent.

Otter soils are commonly near Elburn and Pella soils on the landscape. Elburn soils have an argillic horizon, are underlain by glacial drift, and are somewhat poorly drained. Pella soils are poorly drained and are underlain by glacial drift.

Typical pedon of Otter silt loam, 1,650 feet north and 1,650 feet east of the SW corner of sec. 26, T. 10 N., R. 16 E.

A11—0 to 5 inches; black (10YR 2/1) silt loam; moderate fine granular structure; friable; neutral; clear smooth boundary.
A12—5 to 13 inches; very dark gray (10YR 3/1) silt loam; few fine prominent dark reddish brown (5YR 3/4) mottles; massive; friable; mildly alkaline; abrupt smooth boundary.
A13—13 to 20 inches; black (10YR 2/1) silt loam; weak fine subangular blocky structure; friable; mildly alkaline; clear smooth boundary.
A14—20 to 36 inches; very dark gray (10YR 3/1) silt loam; massive; friable; mildly alkaline; clear smooth boundary.
C—36 to 60 inches; dark gray (10YR 4/1) silt loam; massive; friable; mildly alkaline.

The thickness of the A horizon and mollic epipedon ranges from 24 to 36 inches. Reaction in the A and C horizons ranges from slightly acid to mildly alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 1 to 3, and chroma of 0 to 2. The A1 horizon is dominantly silt loam, but the range includes mucky silt loam. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 0 to 2. Reaction is neutral or mildly alkaline.

Palms series

The Palms series consists of deep, very poorly drained soils that are moderately rapidly permeable in the upper part and moderately or moderately slowly permeable in the lower part. These soils are on glacial lake plains and in depressions on till plains and moraines. They formed in decomposed herbaceous material, which is underlain by loamy material. Slopes are 0 to 2 percent.

Palms soils are commonly near Adrian Variant, Houghton, and Pella soils. Adrian Variant soils are

underlain by stratified fine sand and silt. Houghton soils have organic layers that are more than 51 inches thick. Pella soils have a solum of silty clay loam and a mollic epipedon and are underlain by gravelly loam till.

Typical pedon of Palms muck, 1,300 feet north and 2,500 feet west of the SE corner of sec. 10, T. 9 N., R. 16 E.

Oa1—0 to 6 inches; black (10YR 2/1) broken face and very dark brown (10YR 2/2) rubbed sapric material, about 5 percent fiber, less than 5 percent rubbed; weak fine subangular blocky structure; very friable; neutral; gradual wavy boundary.

Oa2—6 to 12 inches; black (5YR 2/1) broken face and rubbed sapric material, about 5 percent fiber, less than 5 percent rubbed; few woody fibers; weak medium subangular blocky structure; very friable; neutral; gradual wavy boundary.

Oa3—12 to 20 inches; black (5YR 2/1) broken face and rubbed sapric material, about 5 percent fiber, less than 5 percent rubbed; moderate medium subangular blocky structure; very friable; neutral; clear wavy boundary.

Oa4—20 to 26 inches; dark reddish brown (5YR 2/2) broken face and rubbed sapric material, about 10 percent fiber, about 5 percent rubbed; few woody fibers; about 5 percent silt; weak medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.

IICg—26 to 60 inches; light gray (10YR 5/1) silty clay loam; few medium distinct brown (10YR 5/3) mottles; massive; firm; neutral.

The organic layers are 16 to 51 inches thick. Reaction is neutral or mildly alkaline. The upper sapric layers have hue of 10YR, 7.5YR, or 5YR; value of 2; and chroma of 0 to 2. Some pedons have thin layers of hemic material or woody fragments. The IICg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 or 2. It is silty clay loam, clay loam, or loam and is neutral or mildly alkaline.

Pella series

The Pella series consists of deep, poorly drained, moderately permeable soils in depressions between drumlins and on glacial lake plains. These soils formed in silty material mainly more than 3 feet thick which is underlain by glacial till. Slopes are 0 to 2 percent.

Pella soils are commonly near Ackmore, Elburn, and Palms soils on the landscape. Ackmore soils have a lighter colored or thinner surface layer. Elburn soils have an argillic horizon and are somewhat poorly drained. Palms soils have organic layers that are 16 to 51 inches thick over silty clay loam.

Typical pedon of Pella silty clay loam, 1,050 feet north and 500 feet west of the SE corner of sec. 14, T. 10 N., R. 14 E.

A1—0 to 9 inches; black (10YR 2/1) silty clay loam; weak fine granular and subangular blocky structure; friable; neutral; gradual wavy boundary.

A3—9 to 14 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium subangular blocky structure; friable; neutral; gradual wavy boundary.

B2g—14 to 30 inches; olive gray (5Y 4/2) silty clay loam; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; mildly alkaline; gradual wavy boundary.

B3g—30 to 46 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct light yellowish brown (2.5Y 6/4) mottles; weak coarse subangular blocky structure; firm; slight effervescence; mildly alkaline; clear wavy boundary.

IIC—46 to 60 inches; light yellowish brown (2.5Y 6/4) gravelly loam; massive; very friable; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 30 to 50 inches. The depth to free carbonates ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 14 to 18 inches.

The A horizon has hue of 10YR or 2.5Y, value of 1 to 3, and chroma of 0 to 2. It is dominantly silty clay loam, but the range includes silt loam. The Bg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 to 3. It is silty clay loam or silt loam and is mildly alkaline or moderately alkaline. The IIC horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is gravelly loam, sandy loam, or silty clay loam and is mildly alkaline or moderately alkaline. Gravel content ranges from 0 to 20 percent. Content of coarse fragments that are more than 3 inches in diameter ranges from 0 to 5 percent.

Pella Variant

The Pella Variant consists of moderately deep, poorly drained and very poorly drained, moderately slowly permeable soils in depressions between drumlins and on ground moraines. These soils formed in silty material and in the underlying glacial till, which is underlain by dolomite bedrock at a depth of 20 to 40 inches. Slopes are 0 to 2 percent.

Pella Variant soils are commonly near Knowles and Knowles Variant soils on the landscape. Knowles soils have an ochric epipedon and an argillic horizon and are well drained. Knowles Variant soils have an argillic horizon and are somewhat poorly drained.

Typical pedon of Pella Variant silt loam, 650 feet north and 140 feet west of the SE corner of sec. 35, T. 12 N., R. 16 E.

A1—0 to 11 inches; black (10YR 2/1) silt loam; weak fine granular structure; friable; mildly alkaline; gradual wavy boundary.

A3—11 to 15 inches; very dark gray (10YR 3/1) silty clay loam; weak medium subangular blocky structure; firm; mildly alkaline; gradual wavy boundary.

B2g—15 to 28 inches; olive gray (5Y 4/2) silty clay loam; dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; firm; moderately alkaline; abrupt wavy boundary.
IIR—28 to 60 inches; light brownish gray (10YR 6/2) creviced dolomite.

The thickness of the solum and loess mantle and depth to dolomite range from 20 to 40 inches. The thickness of the mollic epipedon ranges from 14 to 18 inches.

The A horizon has hue of 10YR or 2.5Y, value of 1 to 3, and chroma of 0 to 2. It is dominantly silt loam, but the range includes silty clay loam. The B2g horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 to 3. The IIR horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 2 or 3. In most places, the dolomite is hard and unweathered; in other places, it is weathered and creviced, and soil material from the B2g horizon fills these crevices.

Plano series

The Plano series consists of deep, well drained and moderately well drained, moderately permeable soils on ground moraines and drumlins. These soils formed in loess or other silty material and in the underlying glacial till. Slopes range from 0 to 6 percent.

Plano soils are commonly near Elburn, Lomira, and Mendota soils on the landscape. Elburn soils and the Plano soils formed in similar material, but Elburn soils are somewhat poorly drained. Lomira soils have an ochric epipedon. Lomira soils and Mendota soils have a thinner solum and are underlain by glacial till that contains more dolomite.

Typical pedon of Plano silt loam, 0 to 2 percent slopes, 100 feet south and 500 feet west of the NE corner of sec. 16, T. 13 N., R. 14 E.

Ap—0 to 12 inches; very dark gray (10YR 3/1) silt loam; weak fine subangular blocky and granular structure; friable; neutral; abrupt smooth boundary.
A12—12 to 18 inches; dark brown (10YR 3/3) silt loam; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.
B1—18 to 23 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; slightly acid; clear wavy boundary.
B21t—23 to 34 inches; brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; firm; thin discontinuous clay films on faces of peds; medium acid; gradual wavy boundary.
B22t—34 to 50 inches; dark brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; firm; thick continuous clay films on faces of peds; many fine pores; medium acid; gradual wavy boundary.
B31—50 to 58 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure; friable; many fine pores; slightly acid; abrupt wavy boundary.
IIB32—58 to 60 inches; dark brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; few fine pebbles; neutral.

The thickness of the solum and depth to unweathered glacial till range from 45 to about 70 inches. The thickness of the silty material ranges from 45 to 60 inches. The thickness of the mollic epipedon ranges from 14 to 18 inches.

The Ap and A1 horizons have value of 2 or 3 and chroma of 1 or 2. The B1 horizon has value of 3 to 5 and chroma of 3 or 4. The B2t horizon has value of 4 or 5 and chroma of 3 or 4. In some pedons, there are yellowish brown or dark yellowish brown mottles. The B3 horizon is similar in color to the B2t horizon. It is silty clay loam or silt loam. The IIB3 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, silt loam, or sandy loam. Reaction in the B and IIB horizons ranges from medium acid to neutral. The IIC horizon has value of 4 or 5 and chroma of 3 or 4. It is loam, silt loam, or sandy loam and ranges from neutral to moderately alkaline.

Puchyan series

The Puchyan series consists of deep, well drained and moderately well drained soils on drumlins and moraines. These soils formed in windblown sandy sediment over loamy and silty deposits, which are underlain by glacial till or drift. Slopes range from 2 to 6 percent.

Puchyan soils are commonly near Chelsea and Sisson soils on the landscape. Chelsea soils are sandy throughout. Sisson soils formed in loamy lacustrine material.

Typical pedon of Puchyan loamy fine sand, 2 to 6 percent slopes, 100 feet east and 2,000 feet south of the NW corner of sec. 27, T. 11 N., R. 13 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.
A21—9 to 13 inches; yellowish brown (10YR 5/4) loamy fine sand; weak medium subangular blocky structure; very friable; medium acid; clear smooth boundary.
A22—13 to 27 inches; light yellowish brown (10YR 6/4) fine sand; weak medium subangular blocky structure in places; single grained where disturbed; very friable; medium acid; clear smooth boundary.
IIB1—27 to 30 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; slightly acid; clear smooth boundary.
IIB21t—30 to 36 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure;

friable; thin patchy clay films on faces of peds; slightly acid; clear smooth boundary.

IIB22t—36 to 46 inches; brown (10YR 4/3) silt loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; slightly acid; clear smooth boundary.

IIC1—46 to 54 inches; brown (10YR 4/3) silt loam; few medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; neutral; abrupt smooth boundary.

IIIC2—54 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; massive; about 18 percent gravel and 4 percent cobblestones; friable, firm in some places; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 36 to 60 inches. The thickness of the sandy mantle ranges from 20 to 30 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The A2 horizon has value of 4 to 6 and chroma of 3 or 4. It is loamy fine sand or fine sand and ranges from strongly acid to slightly acid. The IIB1 and IIB21t horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 and are medium acid or slightly acid. The IIB22t horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4 and is slightly acid or neutral. In some pedons, there are yellowish brown or dark yellowish brown mottles. The IIC horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam, gravelly loam, loam, or sandy loam. Gravel content ranges from 0 to 20 percent. Content of coarse fragments, which are more than 3 inches in diameter, ranges from 1 to 10 percent.

Rodman series

The Rodman series consists of deep, excessively drained, very rapidly permeable soils on kames, eskers, moraines, and outwash terrace escarpments. These soils formed in gravelly glacial outwash. Slopes range from 6 to 30 percent.

Rodman soils are near Casco, Fox, Hochheim, and Kidder soils. Casco and Fox soils have an ochric epipedon, an argillic horizon, and a thicker solum. Hochheim and Kidder soils have an argillic horizon and are underlain by till.

Typical pedon of Rodman gravelly loam in an area of Rodman-Casco complex, 12 to 30 percent slopes, eroded, 2,300 feet north and 2,000 feet east of the SW corner of sec. 12, T. 9 N., R. 17 E.

A1—0 to 5 inches; very dark gray (10YR 3/1) gravelly loam; weak medium granular structure; friable; neutral; clear wavy boundary.

B2—5 to 11 inches; dark yellowish brown (10YR 3/4) gravelly loam; weak medium subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.

C—11 to 60 inches; pale brown (10YR 6/3) sand and gravel; single grained; loose; moderately alkaline.

The thickness of the solum and depth to sand and gravel range from 8 to 12 inches. The thickness of the mollic epipedon ranges from 5 to 7 inches.

The A1 horizon has value of 2 or 3 and chroma of 1 to 3. Gravel content ranges from 15 to 35 percent. The B2 horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4 and is neutral or mildly alkaline. The C horizon has value of 5 or 6 and chroma of 3 to 6. Strata of sand and gravel range from one-half inch to several feet in thickness.

St. Charles series

The St. Charles series consists of deep, moderately well drained and well drained soils that are moderately permeable throughout or are moderately permeable in the upper part and very rapidly permeable in the substratum. These soils are on ground moraines, drumlins, and outwash plains. They formed mainly in loess or silty colluvium and in the underlying loamy glacial till. Slopes range from 0 to 12 percent.

St. Charles soils are commonly near Dodge, Elburn, and McHenry soils on the landscape. Dodge soils have a thinner silty mantle and solum than St. Charles soils. Elburn soils have a mollic epipedon and are somewhat poorly drained. McHenry soils have a thinner silty mantle and solum and are underlain by gravelly sandy loam till.

Typical pedon of St. Charles silt loam, 2 to 6 percent slopes, 650 feet south and 650 feet west of the NE corner of sec. 32, T. 9 N., R. 13 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 10 inches; brown (10YR 5/3) silt loam; moderate thin platy structure; friable; slightly acid; clear smooth boundary.

B1—10 to 15 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; firm; medium acid; clear wavy boundary.

B21t—15 to 33 inches; brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; thin clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—33 to 42 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; thin clay films on faces of peds; strongly acid; gradual smooth boundary.

IIB31—42 to 50 inches; dark brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few thin patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

IIB32—50 to 60 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.

The thickness of the solum and depth to unweathered glacial till range from 45 to 65 inches. The thickness of the silty material ranges from 40 to 60 inches.

The Ap horizon has value of 3 or 4 and chroma of 2. The A2 horizon has value of 4 to 6 and chroma of 3. The B1 horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam or silty clay loam. The B2t horizon has value of 4 and chroma of 3 or 4 and ranges from strongly acid to mildly alkaline. The IIB horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, or sandy loam and ranges from medium acid to mildly alkaline. In some pedons, the lower part of the solum contains yellowish brown and dark yellowish brown mottles. The IIC horizon is sandy loam, loam, or, less commonly, silt loam. In other pedons, it is sand and gravel below a depth of 4 feet.

Sebewa series

The Sebewa series consists of deep, poorly drained and very poorly drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils are in depressions on outwash plains and stream terraces. They formed in silty and loamy deposits, which are underlain by sand or sand and gravel. Slopes are 0 to 2 percent.

Sebewa soils are commonly near Casco, Fox, and Ionia soils. Casco, Fox, and Ionia soils have an ochric epipedon. Casco soils are well drained and are shallower to sand and gravel than the Sebewa soils. Fox soils are well drained, and Ionia soils are moderately well drained.

Typical pedon of Sebewa silt loam, 2,000 feet north and 1,600 feet west of the SE corner of sec. 14, T. 10 N., R. 16 E.

Ap—0 to 6 inches; very dark brown (10YR 2/2) silt loam; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A12—6 to 12 inches; very dark brown (10YR 2/2) silt loam containing a relatively large amount of sand; moderate coarse subangular blocky structure; friable; neutral; abrupt wavy boundary.

B21t—12 to 21 inches; dark gray (10YR 4/1) clay loam; common fine faint grayish brown (10YR 5/2) and common fine prominent yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few thin patchy clay films on faces of peds; about 5 percent fine gravel; neutral; clear wavy boundary.

B22t—21 to 27 inches; grayish brown (10YR 5/2) clay loam; common fine faint dark gray (10YR 4/1) and common medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; about 5 percent fine gravel; few thin clay films; slightly acid; abrupt wavy boundary.

IIC—27 to 60 inches; pale brown (10YR 6/3) medium and coarse sand; common medium prominent yellowish brown (10YR 5/6) mottles; single grained; loose; a thin layer of light brownish gray (10YR 6/2) very fine sand at a depth of 35 inches; strong effervescence; moderately alkaline.

The thickness of the solum and depth to sand or sand and gravel range from 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The B2t horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is clay loam, loam, or sandy clay loam and ranges from slightly acid to mildly alkaline. The IIC horizon has hue of 10YR or 2.5Y, value of 6 or 7, and chroma of 2 to 4. It is sand or sand and gravel and is mildly alkaline or moderately alkaline.

Sisson series

The Sisson series consists of deep, well drained, moderately permeable soils on glacial lake plains and on ground moraines and drumlins that are adjacent to glacial lake plains. These soils formed mainly in eolian deposits and in loamy lacustrine sediment. Slopes range from 0 to 25 percent.

Sisson soils are commonly near Keowns, Kibbie, and Pella soils on the landscape. Keowns soils do not have an argillic horizon, contain less clay in the subsoil than Sisson soils, have a darker colored surface layer, and are poorly drained. Kibbie soils have a darker colored surface layer and are somewhat poorly drained. Pella soils are poorly drained and have a mollic epipedon. They formed in silty sediments, which are underlain by glacial till.

Typical pedon of Sisson fine sandy loam, 2 to 6 percent slopes, 2,400 feet north and 600 feet east of the SW corner of sec. 36, T. 9 N., R. 16 E.

Ap—0 to 8 inches; dark gray (10YR 4/1) fine sandy loam; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A2—8 to 12 inches; brown (10YR 5/3) fine sandy loam; weak thick platy structure parting to weak fine subangular blocky; friable; neutral; clear smooth boundary.

B1—12 to 17 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; neutral; gradual wavy boundary.

B21t—17 to 30 inches; brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

B3—30 to 36 inches; brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; neutral; gradual wavy boundary.

IIC—36 to 60 inches; pale brown (10YR 6/3) stratified silt and very fine sand; few fine prominent brownish yellow (10YR 6/6) mottles; massive; very friable; neutral.

The thickness of the solum and depth to free carbonates range from 30 to 42 inches.

The Ap horizon has value of 4 or 5 and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes loam and silt loam. The A2 horizon has value of 5 or 6 and chroma of 2 or 3. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, clay loam, silt loam, or silty clay loam; in the lower part it can be fine sandy loam or very fine sandy loam. Reaction ranges from slightly acid to mildly alkaline. The IIC horizon has value of 4 to 6 and chroma of 3 or 4 and ranges from neutral to moderately alkaline. It is stratified silt and very fine sand but contains strata of silt loam, silty clay loam, sand, or fine sand in some pedons.

Theresa series

The Theresa series consists of deep, well drained, moderately permeable or moderately slowly permeable soils on drumlins and moraines. These soils formed in loess and in the underlying loamy glacial till, which has a calcium carbonate equivalent of about 40 to 60 percent. Slopes range from 2 to 30 percent.

Theresa soils are commonly near Dodge, Hochheim, or Mayville soils on the landscape. Dodge soils have a thicker layer of loess and contain less dolomite in the underlying till than Theresa soils. Hochheim soils have a mollic epipedon and have a thinner loess mantle and solum. Mayville soils are moderately well drained. They have a thicker layer of loess and contain less dolomite in the underlying till than the Theresa soils.

Typical pedon of Theresa silt loam, 2 to 6 percent slopes, 2,500 feet south and 600 feet east of the NW corner of sec. 28, T. 9 N., R. 17 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A2—8 to 11 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; netural; abrupt smooth boundary.

B1—11 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; clear wavy boundary.

B2t—15 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common thin clay films on faces of peds; neutral; clear wavy boundary.

IIB22t—21 to 30 inches; brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; continuous thick clay films on faces of peds and in pores; slightly acid; clear wavy boundary.

IIB3t—30 to 39 inches; brown (7.5YR 5/4) loam; weak medium subangular blocky structure; firm; few patchy clay films on faces of peds; many small pebbles; neutral; gradual wavy boundary.

IIC—39 to 60 inches; light yellowish brown (10YR 6/4) sandy loam; massive; friable; about 5 percent fine pebbles and few cobblestones; strong effervescence; moderately alkaline.

The thickness of the solum and depth to unweathered glacial till range from 20 to 40 inches. The thickness of the loess mantle ranges from 10 to 22 inches.

The Ap horizon has value of 2 to 4 and chroma of 2 or 3. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B1 and B2t horizons have value and chroma of 3 or 4 and are slightly acid or neutral. The IIB2t and IIB3t horizons have hue of 10YR or 7.5YR and value and chroma of 3 or 4 and range from neutral to moderately alkaline. Gravel content ranges from 0 to about 15 percent. The IIC horizon has value of 3 to 7 and chroma of 3 or 4. It is loam, gravelly loam, or gravelly sandy loam. Gravel content ranges from 5 to 50 percent. Content of flagstones and other coarse fragments ranges from 0 to 10 percent.

formation of the soils

This section discusses the factors of soil formation, relates them to the formation of the soils in the survey area, and explains the processes of soil formation.

factors of soil formation

The factors that determine the kind of soil that forms at any given point are composition of the parent material, climate under which the soil material has accumulated and weathered, plant and animal life on and in the soil, relief, and length of time the processes of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plant life, are active factors of soil formation. They alter the accumulated material and bring about the development of genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

parent material

The parent materials of the soils in this survey area are glacial till, glacial and stream outwash, loess, lacustrine material, and organic deposits. Many of the soils in Dodge County formed in two or more parent materials. The Puchyan soil, for example, formed in three parent materials. The upper part of the profile formed in sandy material, and the middle part formed in windblown silt; the substratum is gravelly loam glacial till. Some soils are underlain by dolomite bedrock at a depth of less than 40 inches. The bedrock has contributed very little to the character of the soil above it.

Most of the soils in Dodge County formed in a thin layer of loess over other material. In some areas, lacustrine material is in depressions in ground moraines, between drumlins, or in nearly level areas where glacial melt waters have been blocked. In areas that were once shallow lakes, there are thick deposits of plant remains from which organic soils have formed.

The entire survey area was affected in some manner by glaciation. The last glacial deposits were laid down about 12,000 to 14,000 years ago. Glacial till was deposited as moraines and drumlins. Water-sorted or glacial outwash materials occur as kames and eskers on the landscape.

glacial till

Glacial till consists of sandy loam till, loam till, channery till, and shaly till, all of which generally form moraines or drumlins. Dodge County is near the center of the drumlin belt of southeastern Wisconsin. Drumlins trend southeast in the eastern part of the county, south in the central part, and southwest in the western part of the county. The radiating nature of the drumlin pattern suggests that Dodge County is near the center of the ice flow of the Green Bay lobe. Side slopes of drumlins range from 10 to 30 percent. Few drumlins exceed 100 feet in height and many are 10 to 20 feet higher than the surrounding landscape.

Hochheim, Kidder, and Theresa soils are underlain by neutral to moderately alkaline sandy loam or loam till that is as much as 60 percent carbonates and contains large amounts of gravel, cobblestones, and stones. Slopes range from 0 to 30 percent.

Elburn, Dodge, Mayville, Miami, and Lamartine soils formed mainly in loess over loam or sandy loam till. Dodge and Miami soils are on moraines and drumlins. Slopes are 0 to 30 percent. Elburn, Lamartine, and Mayville soils are on foot slopes or are between drumlins. The carbonate content is less than 60 percent. LeRoy, Markesan, Lomira, and Mendota soils formed in channery till, which contains large amounts of ground dolomite, dolomite gravel, cobblestones, and stones. The carbonate content is more than 60 percent and generally ranges from 60 to 90 percent. The A horizon and the upper part of the B horizon of most of these soils formed in loess.

Knowles and Channahon soils formed in silty material that overlies loamy glacial till, but they are underlain by dolomite bedrock at a depth of less than 40 inches. The bedrock contributed very little to the nature of the soil above it except to truncate the profile. Slopes of the Knowles soils are less than 12 percent. Slopes of the Channahon soils range from 1 to 30 percent. The glacial till is generally less than 60 percent carbonates.

Neda and Neda Variant soils formed in loess that overlies glacial till that contains large amounts of shale. The B horizon of these soils is more clayey than that of most other soils in the county.

In the southwest corner of the county there are protruding crests of bluish gray quartzite that were exposed to erosion prior to glaciation. Parts of this area have a thin cover of glacial till. Because of the limited extent of this area, soils were given the names of established series and symbols that indicate rock outcrops.

glacial and stream outwash

During the recession of the glaciers, melt water moved, sorted, and redeposited large quantities of material from moraines and drumlins. Most of this material is moderately alkaline sand and gravel. Much of it was deposited as eskers and kames, and some was deposited as outwash plains. A well developed esker system extends southeastward from near Horicon to the eastern boundary of the survey area. Most of the material in eskers is waterworn and is a good source of gravel. In Dodge County the Casco, Fox, Ionia, Rodman, and Sebewa soils formed in loamy deposits over sand and gravel outwash material. Granby Variant soils are underlain by sandy outwash material that contains little or no gravel.

lacustrine material

Throughout Dodge County, lacustrine deposits are in depressions in ground moraines or between drumlins or in glacial lake plains, where glacial melt water was blocked for long periods. These deposits are mostly sandy and silty and are stratified. Colwood, Keowns, Kibbie, and Sisson soils are underlain by lacustrine deposits.

loess

The A horizon and much of the B horizon of most of the soils in Dodge County formed in loess. The loess appears to be locally derived during a drying period following withdrawal of the glaciers. In a few soils the layer of loess is either thin or absent. In such soils as St. Charles and Plano soils, the A horizon and part of the B horizon formed in loess. Chelsea and Puchyan soils and other sandy soils formed in local eolian sandy material.

organic deposits

Following glaciation, low areas in Dodge County became lakes. Some of the lakes were so shallow that plants such as rushes, reeds, wild rice, and pond lilies grew in the lake bed. The remains of these plants did not rot because they were covered by water. In many places, several feet of this material has accumulated as muck. Houghton soils formed in thick organic deposits. Adrian Variant soils formed in thinner organic deposits over sandy material, and Palms soils formed in organic deposits over loamy mineral soil material.

climate

Climate affects soil formation through the moisture and heat it contributes to an environment. It directly affects the weathering of rocks and the alteration of parent material through the mechanical action of freezing and thawing and the chemical action of leaching by water. It indirectly affects soil formation through its influence on plant and animal life.

Differences in climate within the survey area are too small to significantly account for differences among the soils. The survey area is within a climatic zone, however, where both prairie vegetation and woodland vegetation are competing for dominance. Mendota and Plano soils are representative of soils that formed under grassland vegetation; they have a thick, dark-colored surface layer. Dodge, Kidder, and LeRoy soils formed under woodland vegetation and do not have a thick, dark-colored surface layer.

plant and animal life

Plants and animals in and on the soil provide organic matter and mix the soil material. They bring plant nutrients from the lower horizons to the upper horizons.

The influence of different kinds of vegetation on the formation of soils is shown by the differences in the color of soils that formed under trees and those that formed under prairie grasses. Plano soils formed under grass and have a thick, dark-colored surface layer. Kidder soils formed under trees and have a lighter colored and thinner surface layer. They are generally more acid than soils that formed under grass. Soils that formed under grass accumulate more organic matter and retain it longer than soils that formed under trees. The humus contributes to their darker color. Soils that formed under a mixture of trees and grasses generally have characteristics intermediate between those of woodland and prairie soils.

Man's activities have greatly affected the natural soil-forming processes. Man has greatly altered many soils by clearing, burning, and cultivating. By repeatedly removing plant cover from terraces and uplands, he has contributed to accelerated erosion. Through overcultivation, he has contributed to the loss of organic matter. Through overcultivation and the use of heavy equipment, he has changed the loose porous surface layer to clods and has reduced the infiltration rate.

Where good management and suitable crop rotations have been used, the soil has not been changed adversely, and crop yields have gradually increased. The addition of animal manure and the growth of grasses such as bromegrass have increased the organic matter content of the surface layer and upper part of the subsoil beyond that in virgin woodland soils.

Man has altered the natural acidity of the soils by applying lime to the soils. The lime has not only improved plant growth but has created a more favorable environment for soil bacteria. The increased bacterial action, in turn, has hastened the decomposition of organic matter that darkens the cultivated part of many soils.

Man has also applied fertilizer to increase the supply of plant nutrients. He has grown alfalfa, which with its

long taproots transfers calcium and other plant nutrients from the lower part of the subsoil and the substratum to the surface layer.

Man has improved soil drainage by constructing waterways and building water control structures. By draining wetlands he has permitted cultivation of many high potential soils but has contributed to a general lowering of the water table throughout the area.

Evidence of man's activity can also be seen in areas where much of the original surface layer has eroded and brown subsoil material is exposed. This soil loss is also apparent on foot slopes and along natural drainageways, where sediment washed from the surrounding soils is 2 to 3 or more feet thick. Included in mapping with the Elburn, Pella, and Plano soils were areas of soils that formed in sediment overlying an older, buried soil.

Other changes brought about by man include the tendency towards more flash flooding where woodland cover was removed from the more sloping soils of the watershed; rapid filling of lakes and reservoirs with sediment; contamination of ground water by effluent and fertilizers, especially nitrates; and the general effect of pesticides on soil organisms and ground water. All of man's activities affect the soil in some way, but some of the effects will not be evident for many years.

relief

The hills, valleys, benches, and plains of Dodge County are the work of rain, rivers, winds, glacial ice, and glacial melt water over long periods of time. Where bedrock controls the topography, the resistance or lack of resistance of the underlying rocks has determined the relief. Relief, in turn, influences soil formation by controlling drainage, runoff, and other direct or indirect effects of water, including erosion. In many places, the relief of a given soil can be correlated closely with the drainage, the thickness and organic matter content of the A1 horizon, the depth of the solum, and the differentiation of horizons in the soil profile.

In Dodge County, the surface layer of the more sloping soils generally is light colored, and that of the more gently sloping soils and of the soils in areas where the slope changes from convex to concave is successively darker and thicker. Runoff is slower where the slopes are more gentle, and consequently more water soaks into the soil. As a result, plants grow better on the gentler slopes and more organic matter accumulates in the A1 horizon.

The relationship of relief to soil formation is shown by the general pattern of thin, steep soils and of progressively better developed, deeper soils that have gentler slopes. The deeper soils contain more clay in the subsoil than the thin, steep soils. Fox and Rodman soils, which formed in the same kind of parent material, show the influence of relief on soil development. The more gently sloping Fox soils have a loamy subsoil that is characteristic of clay accumulation, and they have a well-defined B horizon; the generally more sloping Rodman soils do not. The Fox soils are deeper than the Rodman soils.

Drainage characteristics are generally reflected in the color, degree, and kind of mottling or gleying in the soil horizon. Well drained Dodge, Kidder, and Mendota soils are mottle-free throughout the solum. Plano and St. Charles soils are well drained and moderately well drained. Many of these nearly level and gently sloping soils have mottles in the lower part of the B horizon.

Elburn, Kibbie, and Lamartine soils are representative of the somewhat poorly drained soils in the county. They are mottled throughout the B and C horizons. Colwood, Keowns, and Pella soils are representative of the poorly drained soils in the county. They are generally mottled in the A horizon and gleyed in the B and C horizons.

time

Time has had some effect on differences among the soils of the survey area. Soils of the alluvial plains, for example, do not have distinct horizons because the soil material has not been in place long enough for the soil-forming processes to take full effect. Well drained soils that formed in glacial till and in loess, on the other hand, have well-defined horizons as the result of processes that have been active for thousands of years. In some soils along natural drainageways, such as the Elburn, Juneau, Pella, and Plano soils, new material is added to the surface from time to time and covers an older soil. This material has not been in place long enough for distinct horizons to have formed.

processes of soil horizon differentiation

A combination of basic processes is responsible for horizon differentiation. There are four main processes: *gains, losses, transfers*, and *transformations*. Some changes promote horizon differentiation and others retard or offset horizon differentiation. The balance among changes determines the nature of the soil at any given point (*8*).

An example of how these soil-forming processes interact can be seen in the Plano soils. The parent material of these soils is loess and calcareous gravelly sandy loam till. The loess was probably deposited over the till during and after the glacial period. Because these soils are high on the landscape and are underlain by porous till, they are well drained and moderately well drained. The climate was favorable for the growth of plants. Plants and animals contributed to the accumulation of organic matter and organic acids, and they mixed the soil to some extent. These processes accelerated as more and higher forms of organisms grew in the soil and produced a greater volume of organic residue and acids.

Free lime in the soil material gradually dissolved and was moved downward by percolating waters into the

lower part of the soil. As water continued to move downward through the soil, suspended particles of clay also were translocated. As a result, Plano soils have more clay in the lower part of the silty layer and in the upper part of the glacial till than in other parts. While clay was being moved downward in the soil, organic matter in various stages of decomposition was accumulating on or near the surface. This decomposed organic matter gave the surface layer a darker color than it originally had.

While these changes were occurring in the silty part of the soil, the loamy lower part was forming in till of mixed mineralogy that contained a significant amount of dolomite fragments. Chemical weathering of the dolomite and other weatherable minerals gradually changed this layer to a mixture of gravel and sandy loam. Oxidized iron, which occurs as impurities in the dolomite, gives this layer a darker color than the underlying unweathered till.

As a result of these soil-forming processes, the Plano soils now have a surface layer of silt loam and a subsoil that consists of silt loam in the upper part, silty clay loam in the middle part, and yellowish brown loam in the lower part. These soils are underlain at a depth of more than 60 inches by unweathered till that has changed little since it was deposited by the glacier.

Processes that took place in the formation of Plano soils, then, were *gains* of organic matter in the surface layer, *loss* of clay from the upper part of the soil and subsequent *transfer* to the lower part of the subsoil, and *transformation* of iron compounds in the lower subsoil.

All these processes are active in all soils of the survey area. The kinds of parent material and relief have, to a great extent, determined the kinds of processes that are dominant in the formation of the soils

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) Beatty, M. T., E. A. Brickbauer, A. J. Klingelhoets, and D. A. Rohwede. 1966. What yields from Wisconsin soils? Univ. Wis. Ext. Serv., Spec. Circ. 65, 19 pp.

(4) Cotter, R. D., R. D. Hutchinson, E. L. Skinner, and D. A. Wentz. 1969. Water resources of Wisconsin Rock-Fox River Basin. U. S. Dep. Inter. Geol. Surv. Hydrol. Invest. Atlas HA-360.

(5) Curtis, John T. 1971. The vegetation of Wisconsin: an ordination of plant communities. Univ. Wis. Press, Madison.

(6) Martin, Lawrence. 1932. The physical geography of Wisconsin. Wis. Geol. and Nat. Hist. Surv. Bull. No. 36 [Ed. Ser. No. 4] 608 pp., illus.

(7) Shaw, Samuel P. and C. Gordon Fredine. 1956. Wetlands of the United States. U. S. Dep. Inter. Fish and Wildl. Serv. Circ. 39. 67 p., illus.

(8) Simonson, Roy W. 1969. Outline of a generalized theory of soil genesis. Soil Sci. Soc. Am. Proc. 23: 152-156, illus.

(9) 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.]

(10) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(11) United States Department of Agriculture. 1970. Wisconsin soil and water conservation needs inventory.

(12) United States Department of Agriculture. 1975. Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys. U. S. Dep. Agric. Handb. 436, 754 pp., illus.

(13) Wisconsin Department of Natural Resources. 1968. Wisconsin forest resource statistics, southern survey report.

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	9 to 12
Very high	More than 12

Base material (engineering). A layer of gravel, crushed rock, or stabilized soil material beneath the road surface. Base material distributes surface loads to the underlying layers.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, dolomite, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

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 (light 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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave. Unstable walls of cuts made by earthmoving 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.

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.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

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.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

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.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

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.

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.

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.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock 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.

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.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential.

They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

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.

Light textured soil. Sand and loamy sand.

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.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

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.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

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.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

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.

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).

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.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

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

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts 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.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. 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.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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. In this survey area, the slope is *nearly level* if it is 0 to 2 percent, *gently sloping* if 2 to 6 percent, *sloping* if 6 to 12 percent, *moderately steep* if 12 to 18 percent, *steep* if 18 to 30 percent, and *very steep* if more than 30 percent.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

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.

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).

Subgrade (engineering). The foundation layer of local soil material, whether cut or fill.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

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.

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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

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.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1930-59 at Burnett, Wisconsin]

Month	Temperature				Precipitation				
			2 years in 10 will have--			1 year in 10 will have--			
	Average daily maximum	Average daily minimum	Maximum temperature equal to or higher than--	Minimum temperature equal to or lower than--	Average total	Less than--	More than--	Days with 0.1 inch or more	Average depth of snow on days with snow cover
	°F	°F	°F	°F	In	In	In		In
January---	27.1	9.7	24	12	1.59	0.44	2.05	3	9.3
February--	29.6	11.5	25	17	1.27	0.21	2.10	3	6.1
March-----	39.3	22.1	33	26	2.06	0.56	2.33	4	7.8
April-----	55.8	34.3	48	42	2.76	1.28	3.47	6	1.3
May-------	68.5	44.9	59	54	3.18	1.59	4.74	7	0.3
June------	77.6	55.2	69	63	4.09	2.30	6.08	7	0.0
July------	83.1	58.9	73	69	3.41	1.25	4.96	6	0.0
August----	81.5	57.5	72	67	3.25	1.28	4.94	6	0.0
September-	72.8	49.4	62	59	3.40	1.11	5.34	6	1/
October---	61.3	39.9	53	47	2.27	0.58	4.14	4	1/
November--	43.7	26.8	39	31	2.17	0.52	3.26	4	3.1
December--	30.8	15.2	26	18	1.53	0.59	1.92	3	6.0
Year---	55.9	35.5	---	---	30.98	22.74	33.53	59	33.9

1/ Trace--an amount too small to measure.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1930-59 at Burnett, Wisconsin]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:					
1 year in 10 later than--	Apr. 6	Apr. 11	Apr. 25	May 9	May 21
4 years in 10 later than--	Mar. 30	Apr. 3	Apr. 18	May 2	May 15
6 years in 10 later than--	Mar. 23	Mar. 27	Apr. 11	Apr. 26	May 8
8 years in 10 later than--	Mar. 15	Mar. 19	Apr. 4	Apr. 18	May 2
First freezing temperature in fall:					
1 year in 10 earlier than-	Nov. 8	Oct. 27	Oct. 17	Oct. 2	Sep. 21
4 years in 10 earlier than-	Nov. 16	Nov. 3	Oct. 24	Oct. 10	Sep. 28
6 years in 10 earlier than-	Nov. 22	Nov. 10	Oct. 31	Oct. 17	Oct. 4
8 years in 10 earlier than-	Nov. 30	Nov. 17	Nov. 8	Oct. 24	Oct. 11

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AcA	Ackmore silt loam, 0 to 3 percent slopes	8,450	1.5
Ar	Adrian Variant muck	1,220	0.2
AsA	Ashippun silt loam, 0 to 2 percent slopes	1,880	0.3
AsB	Ashippun silt loam, 2 to 6 percent slopes	1,940	0.3
BsA	Brookston silt loam, 0 to 3 percent slopes	1,430	0.3
CcB	Casco loam, 2 to 6 percent slopes	930	0.2
CcC2	Casco loam, 6 to 12 percent slopes, eroded	1,240	0.2
CcD2	Casco loam, 12 to 18 percent slopes, eroded	960	0.2
CdB	Channahon silt loam, 1 to 6 percent slopes	1,890	0.3
CdC2	Channahon silt loam, 6 to 12 percent slopes, eroded	1,210	0.2
CdD2	Channahon silt loam, 12 to 25 percent slopes, eroded	910	0.2
ChB	Chelsea loamy fine sand, 2 to 6 percent slopes	140	*
ChC	Chelsea loamy fine sand, 6 to 18 percent slopes	260	*
Co	Colwood silty clay loam	1,240	0.2
DdA	Dodge silt loam, 0 to 2 percent slopes	2,070	0.4
DdB	Dodge silt loam, 2 to 6 percent slopes	13,650	2.4
DdC2	Dodge silt loam, 6 to 12 percent slopes, eroded	4,090	0.7
EbA	Elburn silt loam, 0 to 3 percent slopes	39,110	6.9
Ev	Elvers silt loam	860	0.2
FoE2	Fox loam, 18 to 30 percent slopes, eroded	320	0.1
FsA	Fox silt loam, 0 to 2 percent slopes	600	0.1
FsB	Fox silt loam, 2 to 6 percent slopes	7,830	1.4
FsC2	Fox silt loam, 6 to 12 percent slopes, eroded	2,970	0.5
FsD2	Fox silt loam, 12 to 18 percent slopes, eroded	1,290	0.2
Fu	Fluvaquents	500	0.1
FxC3	Fox soils, 6 to 12 percent slopes, severely eroded	590	0.1
Gb	Granby Variant fine sandy loam	270	*
HnB	Hochheim silt loam, 2 to 6 percent slopes	6,070	1.1
HnC2	Hochheim silt loam, 6 to 12 percent slopes, eroded	3,380	0.6
HnD2	Hochheim silt loam, 12 to 18 percent slopes, eroded	1,690	0.3
HnE2	Hochheim silt loam, 18 to 30 percent slopes, eroded	610	0.1
HoD3	Hochheim soils, 12 to 18 percent slopes, severely eroded	560	0.1
Hu	Houghton muck	28,080	4.9
Hw	Houghton muck,ponded	8,600	1.5
IoA	Ionia silt loam, 0 to 3 percent slopes	2,500	0.4
JuA	Juneau silt loam, 0 to 2 percent slopes	1,920	0.3
JuB	Juneau silt loam, 2 to 6 percent slopes	1,760	0.3
Ke	Keowns silt loam	4,120	0.7
KlA	Kibbie loam, 0 to 2 percent slopes	1,850	0.3
KlB	Kibbie loam, 2 to 6 percent slopes	3,200	0.6
KrB	Kidder loam, 2 to 6 percent slopes	1,700	0.3
KrC2	Kidder loam, 6 to 12 percent slopes, eroded	1,910	0.3
KrD2	Kidder loam, 12 to 18 percent slopes, eroded	950	0.2
KrE2	Kidder loam, 18 to 30 percent slopes, eroded	2,810	0.5
KwA	Knowles silt loam, 0 to 2 percent slopes	600	0.1
KwB	Knowles silt loam, 2 to 6 percent slopes	5,770	1.0
KwC2	Knowles silt loam, 6 to 12 percent slopes, eroded	860	0.2
KxA	Knowles Variant silt loam, 0 to 2 percent slopes	740	0.1
KxB	Knowles Variant silt loam, 2 to 6 percent slopes	900	0.2
LmA	Lamartine silt loam, 0 to 2 percent slopes	1,900	0.3
LmB	Lamartine silt loam, 2 to 6 percent slopes	18,410	3.2
LrB	LeRoy silt loam, 2 to 6 percent slopes	10,320	1.8
LrC2	LeRoy silt loam, 6 to 12 percent slopes, eroded	10,420	1.8
LrD2	LeRoy silt loam, 12 to 18 percent slopes, eroded	2,900	0.5
LrE2	LeRoy silt loam, 18 to 30 percent slopes, eroded	700	0.1
LvB	Lomira silt loam, 2 to 6 percent slopes	11,900	2.1
LvC2	Lomira silt loam, 6 to 12 percent slopes, eroded	2,470	0.4
MdB	Markesan silt loam, 2 to 6 percent slopes	710	0.1
MdC2	Markesan silt loam, 6 to 12 percent slopes, eroded	2,030	0.4
MoA	Mayville silt loam, 0 to 2 percent slopes	1,000	0.2
MoB	Mayville silt loam, 2 to 6 percent slopes	9,900	1.7
MoC	Mayville silt loam, 6 to 12 percent slopes	920	0.2
MrB	McHenry silt loam, 2 to 6 percent slopes	4,970	0.9
MrC2	McHenry silt loam, 6 to 12 percent slopes, eroded	7,260	1.3
MrD2	McHenry silt loam, 12 to 18 percent slopes, eroded	2,860	0.5
MsB	Mendota silt loam, 2 to 6 percent slopes	8,150	1.4
MsC2	Mendota silt loam, 6 to 12 percent slopes, eroded	1,590	0.3
MyB	Miami silt loam, 2 to 6 percent slopes	24,500	4.3
MyC2	Miami silt loam, 6 to 12 percent slopes, eroded	23,900	4.2
MyD2	Miami silt loam, 12 to 18 percent slopes, eroded	8,850	1.6

See footnote at end of table.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
MzD3	Miami soils, 12 to 18 percent slopes, severely eroded	6,170	1.1
MzE3	Miami soils, 18 to 30 percent slopes, severely eroded	3,300	0.6
NeB	Neda silt loam, 2 to 6 percent slopes	6,170	1.1
NeC2	Neda silt loam, 6 to 12 percent slopes, eroded	2,720	0.5
NeD2	Neda silt loam, 12 to 18 percent slopes, eroded	620	0.1
NeE2	Neda silt loam, 18 to 30 percent slopes, eroded	290	0.1
NvB	Neda Variant silt loam, 2 to 6 percent slopes	370	0.1
NvC2	Neda Variant silt loam, 6 to 18 percent slopes, eroded	140	*
NxA	Nenno silt loam, 0 to 2 percent slopes	490	0.1
NxB	Nenno silt loam, 2 to 6 percent slopes	1,130	0.2
Ot	Otter silt loam	2,140	0.4
Pa	Palms muck	7,200	1.3
Ph	Pella silty clay loam	27,170	4.8
Pk	Pella Variant silt loam	450	0.1
Pn	Pits	300	0.1
PsA	Plano silt loam, 0 to 2 percent slopes	9,580	1.7
PsB	Plano silt loam, 2 to 6 percent slopes	10,560	1.9
PtA	Plano silt loam, moderately well drained, 0 to 3 percent slopes	16,910	3.0
PuB	Puchyan loamy fine sand, 2 to 6 percent slopes	330	0.1
RcE	Rock outcrop-Channahon complex, 5 to 30 percent slopes	570	0.1
RxC2	Rodman-Casco complex, 6 to 12 percent slopes, eroded	420	0.1
RxD2	Rodman-Casco complex, 12 to 30 percent slopes, eroded	1,300	0.2
ScA	St. Charles silt loam, 0 to 2 percent slopes	23,860	4.2
ScB	St. Charles silt loam, 2 to 6 percent slopes	46,680	8.2
ScC2	St. Charles silt loam, 6 to 12 percent slopes, eroded	4,610	0.8
SdA	St. Charles silt loam, moderately well drained, 0 to 3 percent slopes	12,130	2.1
SeA	St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	1,260	0.2
SeB	St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	700	0.1
Sk	Saprists and Aquents	190	*
Sm	Sebewa silt loam	1,920	0.3
SuA	Sisson fine sandy loam, 0 to 2 percent slopes	470	0.1
SuB	Sisson fine sandy loam, 2 to 6 percent slopes	1,650	0.3
SuC2	Sisson fine sandy loam, 6 to 12 percent slopes, eroded	1,960	0.3
SuD2	Sisson fine sandy loam, 12 to 25 percent slopes, eroded	1,260	0.2
ThB	Theresa silt loam, 2 to 6 percent slopes	14,700	2.6
ThC2	Theresa silt loam, 6 to 12 percent slopes, eroded	14,670	2.6
ThD2	Theresa silt loam, 12 to 18 percent slopes, eroded	4,800	0.8
ThE2	Theresa silt loam, 18 to 30 percent slopes, eroded	1,690	0.3
TrD3	Theresa soils, 12 to 25 percent slopes, severely eroded	1,280	0.2
Ud	Udorthents, loamy	150	*
Uf	Udifluvents	2,560	0.4
	Total	568,960	100.0

* Less than 0.1 percent.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield figure 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	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM*
AcA---- Ackmore	105	17	60	4.5	3.5
Ar---- Adrian Variant	100	17	---	---	3.0
AsA---- Ashippun	115	19	65	4.0	3.5
AsB---- Ashippun	110	18	60	4.0	3.5
BsA---- Brookston	115	19	60	4.5	3.0
CcB---- Casco	70	12	55	2.7	3.0
CcC2---- Casco	65	11	50	2.5	2.5
CcD2---- Casco	---	---	40	2.0	2.5
CdB---- Channahon	60	10	45	2.8	2.5
CdC2---- Channahon	55	9	35	2.5	2.3
CdD2---- Channahon	---	---	---	2.2	2.0
ChB---- Chelsea	55	9	40	2.0	2.0
ChC---- Chelsea	---	---	35	1.5	1.5
Co---- Colwood	95	16	60	4.0	3.0
DdA---- Dodge	105	17	75	5.0	3.0
DdB---- Dodge	105	17	75	5.0	3.0
DdC2---- Dodge	100	17	60	4.5	2.7
EbA---- Elburn	125	20	75	4.5	3.5
Ev---- Elvers	115	19	55	2.5	3.0
FoE2---- Fox	---	---	---	2.0	2.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM*
FsA---- Fox	90	15	75	3.0	3.0
FsB---- Fox	85	14	70	3.0	3.0
FsC2---- Fox	80	13	65	2.5	2.5
FsD2---- Fox	70	12	50	2.5	2.5
Fu. Fluvaquents					
FxC3---- Fox	70	12	45	2.3	1.5
Gb---- Granby Variant	70	12	60	3.0	3.2
HnB---- Hochheim	90	15	65	4.0	3.0
HnC2---- Hochheim	80	13	55	3.5	2.7
HnD2---- Hochheim	65	11	45	3.0	2.5
HnE2---- Hochheim	---	---	35	2.5	2.0
HoD3---- Hochheim	---	---	---	---	1.0
Hu---- Houghton	115	19	---	3.0	3.0
Hw---- Houghton	---	---	---	---	---
IoA---- Ionia	95	16	75	3.0	3.0
JuA---- Juneau	110	18	55	4.5	3.5
JuB---- Juneau	105	17	55	4.5	3.5
Ke---- Keowns	90	15	60	3.0	3.0
KlA---- Kibbie	110	18	65	4.0	3.0
KlB---- Kibbie	105	17	65	4.0	3.5
KrB---- Kidder	100	17	70	4.0	3.0
KrC2---- Kidder	85	14	65	3.5	2.7
KrD2---- Kidder	75	12	55	3.0	2.5
KrE2---- Kidder	---	---	---	---	2.3

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM*
KwA---------- Knowles	105	17	70	3.5	3.0
KwB---------- Knowles	100	17	70	3.5	3.0
KwC2---------- Knowles	90	15	65	3.0	2.7
KxA, KxB---------- Knowles Variant	90	15	70	4.0	3.0
LmA---------- Lamartine	115	19	65	4.0	3.0
LmB---------- Lamartine	115	19	65	4.5	3.0
LrB---------- LeRoy	85	14	60	4.5	3.0
LrC2---------- LeRoy	80	13	55	4.0	2.7
LrD2---------- LeRoy	70	12	50	4.0	2.5
LrE2---------- LeRoy	---	---	40	3.5	2.3
LvB---------- Lomira	100	17	65	4.5	3.0
LvC2---------- Lomira	90	15	60	4.0	2.7
MdB---------- Markesan	85	14	60	4.5	3.0
MdC2---------- Markesan	80	13	55	4.0	2.7
MoA---------- Mayville	105	17	70	4.5	3.0
MoB---------- Mayville	100	17	70	4.5	3.0
MoC---------- Mayville	90	15	65	4.5	2.8
MrB---------- McHenry	100	17	70	5.0	3.0
MrC2---------- McHenry	85	14	65	4.5	2.7
MrD2---------- McHenry	80	13	50	3.5	2.5
MsB---------- Mendota	110	18	80	5.5	3.0
MsC2---------- Mendota	100	17	70	5.0	2.7
MyB---------- Miami	110	18	70	4.0	3.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM*
MyC2---------- Miami	95	16	65	4.0	2.7
MyD2---------- Miami	80	13	60	3.5	2.5
MzD3---------- Miami	---	---	---	2.5	1.5
MzE3---------- Miami	---	---	---	---	1.0
NeB---------- Neda	80	13	70	4.5	3.5
NeC2---------- Neda	75	12	65	4.0	3.5
NeD2---------- Neda	65	11	55	4.0	3.0
NeE2---------- Neda	---	---	45	3.5	2.5
NvB---------- Neda Variant	100	18	70	4.5	2.5
NvC2---------- Neda Variant	80	13	50	3.5	2.5
NxA---------- Nenno	105	17	70	4.0	3.5
NxB---------- Nenno	100	17	65	4.0	3.5
Ot---------- Otter	120	20	50	4.0	3.0
Pa---------- Palms	105	17	---	---	3.0
Ph---------- Pella	125	20	60	4.5	3.0
Pk---------- Pella Variant	70	12	50	4.0	3.0
Pn. Pits					
PsA---------- Plano	130	21	80	5.5	3.5
PsB---------- Plano	125	21	75	5.5	3.5
PtA---------- Plano	130	21	80	5.5	3.5
PuB---------- Puchyan	80	13	50	3.5	2.7
RcE---------- Channahon	---	---	---	---	1.0
RxC2**---------- Rodman	---	---	---	0.7	1.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM*
RxD2**---------- Rodman	---	---	---	---	0.5
ScA---------- St. Charles	125	20	70	5.0	3.5
ScB---------- St. Charles	120	20	65	5.5	3.5
ScC2---------- St. Charles	105	17	60	5.0	3.0
SdA---------- St. Charles	125	20	70	5.0	3.5
SeA---------- St. Charles	125	20	70	5.0	3.5
SeB---------- St. Charles	125	20	65	5.5	3.5
Sk. Saprists and Aquents	---	---	---	---	---
Sm---------- Sebewa	105	17	60	4.0	3.0
SuA---------- Sisson	115	19	70	5.0	3.5
SuB---------- Sisson	105	17	70	5.0	3.5
SuC2---------- Sisson	90	15	60	4.5	3.0
SuD2---------- Sisson	75	12	50	3.5	2.5
ThB---------- Theresa	105	17	70	5.0	3.0
ThC2---------- Theresa	90	15	60	4.5	2.7
ThD2---------- Theresa	80	13	50	3.5	2.5
ThE2---------- Theresa	---	---	---	3.2	2.0
TrD3---------- Theresa	---	---	---	3.0	2.0
Ud. Udorthents					
Uf. Udifluvents					

* 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.

** For yields of the Casco part of this map unit, refer to map symbols CcC2 and CcD2.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES

[All poorly drained and very poorly drained soils are assigned to drained capability subclasses. Miscellaneous areas and soils classified at a level higher than the series are excluded. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	69,200	---	---	---
II	314,170	213,640	96,830	3,700
III	121,520	88,720	32,470	330
IV	29,620	28,260	1,220	140
V	---	---	---	---
VI	17,290	16,870	---	420
VII	4,860	3,300	---	1,560
VIII	8,790	---	8,790	---

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
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
AcA---------- Ackmore	3w	Severe	Severe	Moderate	Severe	Silver maple--------	80	Eastern white pine, red pine, white spruce.
						White ash----------	---	
Ar---------- Adrian Variant	3w	Severe	Severe	Severe	Severe	Red maple----------	55	
						Silver maple--------	---	
						White ash----------	---	
						Quaking aspen-------	---	
						Tamarack-----------	---	
AsA, AsB---------- Ashippun	3o	Slight	Slight	Slight	Slight	Northern red oak----	55	Eastern white pine, white spruce, white ash.
						White ash----------	---	
						Red maple----------	---	
BsA---------- Brookston	4w	Severe	Severe	Moderate	Severe	Silver maple--------	70	White spruce, red maple, white ash.
						Red maple----------	---	
						White ash----------	---	
CcB, CcC2---------- Casco	3s	Slight	Moderate	Slight	Slight	Northern red oak----	55	Red pine, eastern redcedar, jack pine.
						Black oak----------	---	
						White oak----------	---	
CcD2---------- Casco	3s	Moderate	Moderate	Slight	Slight	Northern red oak----	55	Red pine, eastern redcedar, jack pine.
						Black oak----------	---	
						White oak----------	---	
CdB, CdC2---------- Channahon	3d	Slight	Moderate	Moderate	Slight	Northern red oak----	55	Eastern white pine, red pine, jack pine.
						White oak----------	---	
						Shagbark hickory----	---	
CdD2---------- Channahon	3d	Moderate	Moderate	Moderate	Slight	Northern red oak----	55	Eastern white pine, red pine, jack pine.
						White oak----------	---	
						Shagbark hickory----	---	
ChB, ChC---------- Chelsea	3s	Slight	Moderate	Slight	Slight	Northern pin oak----	55	Eastern white pine, red pine, jack pine.
						Black oak----------	---	
						White oak----------	---	
Co---------- Colwood	1w	Severe	Moderate	Moderate	Moderate	White ash----------	70	White spruce, white ash, eastern white pine, silver maple.
						Northern red oak----	---	
						Silver maple--------	---	
DdA, DdB, DdC2----- Dodge	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine, white spruce.
						Black cherry--------	---	
						White oak----------	---	
EbA---------- Elburn	4o	Slight	Slight	Slight	Slight	Silver maple--------	70	Eastern white pine, white spruce.
						White ash----------	---	
Ev---------- Elvers	4w	Severe	Severe	Severe	Severe	Silver maple--------	70	Silver maple, white ash.
						White ash----------	---	
FoE2---------- Fox	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak----------	---	
						Sugar maple---------	---	
FsA, FsB, FsC2----- Fox	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak----------	---	
						Sugar maple---------	---	

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
FsD2---------- Fox	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak----------	---	
						Sugar maple---------	---	
FxC3---------- Fox	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak----------	---	
						Sugar maple---------	---	
Gb---------- Granby Variant	3w	Severe	Severe	Severe	Severe	Green ash----------	55	White ash, silver maple, white spruce.
						White ash----------	---	
						Silver maple--------	---	
						Red maple----------	---	
HnB, HnC2---------- Hochheim	2o	Slight	Slight	Slight	Moderate	Sugar maple---------	58	Red pine, eastern white pine.
						American basswood---	---	
						Northern red oak----	---	
						White ash----------	---	
HnD2, HnE2, HoD3--- Hochheim	2r	Moderate	Slight	Slight	Moderate	Sugar maple---------	58	Red pine, eastern white pine.
						American basswood---	---	
						Northern red oak----	---	
						White ash----------	---	
Hu---------- Houghton	3w	Severe	Severe	Severe	Severe	Red maple----------	55	
						Silver maple--------	---	
						White ash----------	---	
						Quaking aspen-------	---	
						Tamarack-----------	---	
IoA---------- Ionia	1o	Slight	Slight	Slight	Moderate	Northern red oak----	75	Eastern white pine, yellow-poplar, red pine, white spruce.
						Sugar maple---------	---	
						Shagbark hickory----	---	
						American basswood---	---	
JuA, JuB---------- Juneau	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
Ke---------- Keowns	1w	Severe	Moderate	Moderate	Severe	Silver maple--------	95	Silver maple, red maple, white ash.
						Red maple----------	90	
						White ash----------	80	
KlA, KlB---------- Kibbie	2o	Slight	Slight	Slight	Moderate	Sugar maple---------	66	White spruce, eastern white pine, white spruce.
						Northern red oak----	---	
						White oak----------	---	
						White ash----------	---	
						American basswood---	---	
KrB, KrC2---------- Kidder	2o	Slight	Slight	Slight	Moderate	Northern red oak----	62	Eastern white pine, red pine.
						White ash----------	---	
KrD2, KrE2--------- Kidder	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	62	Eastern white pine, red pine.
						White ash----------	---	
KwA, KwB, KwC2----- Knowles	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine.
						White oak----------	---	
						Sugar maple---------	---	
KxA, KxB---------- Knowles Variant	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine, white spruce.
						American basswood---	---	
						Sugar maple---------	---	
LmA, LmB---------- Lamartine	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine, white spruce.
						American basswood---	---	
						Sugar maple---------	---	

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
LrB, LrC2---------- LeRoy	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
						White ash----------	---	
LrD2, LrE2--------- LeRoy	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
						White ash----------	---	
LvB, LvC2---------- Lomira	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
MoA, MoB, MoC------ Mayville	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						White ash----------	---	
						American basswood---	---	
						White oak----------	---	
						Silver maple--------	---	
						Bitternut hickory---	---	
MrB, MrC2---------- McHenry	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine.
						Bur oak------------	---	
						Black cherry--------	---	
MrD2--------------- McHenry	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine.
						Bur oak------------	---	
						Black cherry--------	---	
MyB, MyC2---------- Miami	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine.
						White oak----------	---	
						Sugar maple---------	---	
						White ash----------	---	
MyD2, MzD3, MzE3--- Miami	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine.
						White oak----------	---	
						Sugar maple---------	---	
						White ash----------	---	
NeB, NeC2---------- Neda	2c	Slight	Moderate	Slight	Moderate	Sugar maple---------	60	Eastern white pine, red pine, white spruce.
						Northern red oak----	---	
						White ash----------	---	
						American basswood---	---	
NeD2, NeE2--------- Neda	2c	Moderate	Moderate	Slight	Moderate	Sugar maple---------	60	Eastern white pine, red pine, white spruce.
						Northern red oak----	---	
						White ash----------	---	
						American basswood---	---	
NvB, NvC2---------- Neda Variant	3c	Slight	Moderate	Moderate	Slight	Sugar maple---------	55	Eastern white pine, red pine.
						American basswood---	---	
						Northern red oak----	---	
NxA, NxB---------- Nenno	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine, white spruce.
						American basswood---	---	
						Red maple----------	---	
Ot----------------- Otter	4w	Severe	Moderate	Moderate	Severe	Silver maple--------	80	Green ash, silver maple, eastern cottonwood, white ash.
						White ash----------	---	
Pa----------------- Palms	3w	Severe	Severe	Severe	Severe	Silver maple--------	70	
						Red maple----------	---	
						White ash----------	---	
						Quaking aspen-------	---	
Ph----------------- Pella	4w	Severe	Moderate	Severe	Severe	Silver maple--------	---	
						White ash----------	---	

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
PuB---------- Puchyan	3o	Slight	Slight	Slight	Slight	Black oak----------	55	Red pine, eastern white pine.
						Bur oak----------	---	
						Shagbark hickory----	---	
RcE*: Channahon----------	3d	Moderate	Moderate	Moderate	Slight	Northern red oak----	55	Eastern white pine, red pine, jack pine.
						White oak----------	---	
						Shagbark hickory----	---	
Rock outcrop.								
RxC2*: Rodman----------	4f	Slight	Moderate	Slight	Slight	Northern red oak----	45	Red pine, eastern white pine, eastern redcedar, jack pine.
						White oak----------	---	
Casco----------	3s	Slight	Moderate	Slight	Slight	Northern red oak----	55	Red pine, eastern redcedar, jack pine.
						Black oak----------	---	
						White oak----------	---	
RxD2*: Rodman----------	4f	Moderate	Severe	Slight	Slight	Northern red oak----	45	Red pine, eastern white pine, eastern redcedar, jack pine.
						White oak----------	---	
Casco----------	3s	Moderate	Moderate	Slight	Slight	Northern red oak----	55	Red pine, eastern redcedar, jack pine.
						Black oak----------	---	
						White oak----------	---	
ScA, ScB, ScC2, SdA---------- St. Charles	2o	Slight	Slight	Slight	Moderate	Northern red oak----	64	Red pine, eastern white pine, white spruce, black spruce.
						American basswood---	---	
						Red maple----------	---	
						Sugar maple---------	---	
SeA, SeB---------- St. Charles	2o	Slight	Slight	Slight	Moderate	Northern red oak----	64	Eastern white pine, red pine, white spruce.
						American basswood---	---	
						Red maple----------	---	
						Sugar maple---------	---	
Sm---------- Sebewa	4w	Severe	Severe	Severe	Severe	Red maple----------	85	White spruce, eastern white pine, white ash, red maple.
						White ash----------	---	
						Silver maple--------	---	
SuA, SuB, SuC2----- Sisson	2o	Slight	Slight	Slight	Moderate	Northern red oak----	70+	Eastern white pine, white spruce, red pine.
						White ash----------	---	
						American basswood---	---	
						White oak----------	---	
						Sugar maple---------	---	
SuD2---------- Sisson	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	70+	Eastern white pine, white spruce, red pine.
						White ash----------	---	
						American basswood---	---	
						White oak----------	---	
						Sugar maple---------	---	
ThB, ThC2---------- Theresa	2o	Slight	Slight	Slight	Moderate	Northern red oak----	72	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
ThD2, ThE2--------- Theresa	2r	Moderate	Moderate	Slight	Moderate	Northern red oak----	72	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
TrD3---------- Theresa	2r	Moderate	Moderate	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	

* 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; the symbol > means greater than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AcA---------- Ackmore	Redosier dogwood, gray dogwood.	Autumn-olive------	Amur maple, eastern redcedar.	Red pine, Norway spruce, eastern white pine.	Silver maple.
Ar---------- Adrian Variant	---	Late lilac, nannyberry viburnum, common ninebark.	Japanese tree lilac.	---	Carolina poplar.
AsA, AsB---------- Ashippun	---	Northern white-cedar, redosier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	---
BsA---------- Brookston	Silky dogwood-----	Shadblow serviceberry.	White spruce, nannyberry viburnum, northern white-cedar, white ash.	Eastern white pine, silver maple.	---
CcB, CcC2, CcD2--- Casco	Gray dogwood------	Northern white-cedar, lilac, common ninebark, silky dogwood.	---	Eastern white pine, red pine.	---
CdB, CdC2, CdD2--- Channahon	Autumn-olive, silky dogwood.	---	Eastern white pine, red pine, eastern redcedar.	---	---
ChB, ChC---------- Chelsea	Siberian peashrub, gray dogwood.	Eastern redcedar--	---	Eastern white pine, red pine.	---
Co---------- Colwood	---	Silky dogwood, Tatarian honeysuckle, white spruce.	White spruce------	Eastern white pine.	Carolina poplar.
DdA, DdB, DdC2---- Dodge	Gray dogwood------	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce------	Eastern white pine, red pine.	---
EbA---------- Elburn	Silky dogwood-----	Autumn-olive------	Amur maple, Russian-olive.	Eastern white pine.	---
Ev. Elvers					
FoE2, FsA, FsB, FsC2, FsD2, FxC3- Fox	Gray dogwood------	Autumn-olive, late lilac, American cranberrybush, northern white-cedar, silky dogwood.	Norway spruce, white spruce.	Eastern white pine, red pine.	---
Fu*. Fluvaquents					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Gb. Granby Variant					
HnB, HnC2, HnD2, HnE2, HoD3---- Hochheim	Gray dogwood----	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
Hu, Hw---- Houghton	---	Silky dogwood----	---	---	Carolina poplar.
IoA---- Ionia	Gray dogwood, common lilac.	Silky dogwood, late lilac.	---	Eastern white pine, red pine.	Carolina poplar.
JuA, JuB---- Juneau	Gray dogwood----	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
Ke---- Keowns	---	Northern white-cedar, redosier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, silver maple.	---
KlA, KlB---- Kibbie	---	Silky dogwood, American cranberrybush.	White spruce----	Red pine, eastern white pine.	---
KrB, KrC2, KrD2, KrE2---- Kidder	Gray dogwood----	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
KwA, KwB, KwC2---- Knowles	Gray dogwood----	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
KxA, KxB---- Knowles Variant	Gray dogwood----	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
LmA, LmB---- Lamartine	---	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
LrB, LrC2, LrD2, LrE2---- LeRoy	Gray dogwood----	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
LvB, LvC2---- Lomira	Gray dogwood----	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MdB, MdC2--------- Markesan	Gray dogwood------	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
MoA, MoB, MoC----- Mayville	Gray dogwood------	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
MrB, MrC2, MrD2--- McHenry	Gray dogwood------	Silky dogwood-----	White spruce------	Eastern white pine, red pine.	---
MsB, MsC2--------- Mendota	Gray dogwood------	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
MyB, MyC2, MyD2, MzD3---------- Miami	Gray dogwood------	Late lilac, silky dogwood, common ninebark.	White spruce------	Eastern white pine, red pine.	Green ash.
MzE3---------- Miami	Gray dogwood------	Late lilac, silky dogwood, common ninebark.	White spruce------	Eastern white pine, red pine.	Green ash.
NeB, NeC2, NeD2, NeE2---------- Neda	Gray dogwood------	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
NvB, NvC2--------- Neda Variant	Gray dogwood------	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
NxA, NxB---------- Nenno	---	Northern white-cedar, redosier dogwood, nannyberry viburnum.	White spruce, green ash.	Eastern white pine, jack pine, silver maple.	---
Ot---------- Otter	---	Redosier dogwood, northern white-cedar, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	Carolina poplar.
Pa---------- Palms	---	Silky dogwood-----	---	---	Carolina poplar.
Ph. Pella					
Pk. Pella Variant					
Pn*. Pits					
PsA, PsB, PtA----- Plano	Gray dogwood------	Common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
PuB---------- Puchyan	Gray dogwood------	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
RcE*: Channahon--------	Autumn-olive, silky dogwood.	---	Eastern white pine, red pine, eastern redcedar.	---	---
Rock outcrop.					
RxC2*, RxD2*: Rodman----------	Gray dogwood------	Late lilac, common ninebark.	Eastern redcedar--	Eastern white pine, red pine.	---
Casco----------	Gray dogwood------	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
ScA, ScB, ScC2, SdA---------- St. Charles	Common lilac, gray dogwood.	Silky dogwood, American cranberrybush, common ninebark.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
SeA, SeB---------- St. Charles	Common lilac, gray dogwood.	Silky dogwood, American cranberrybush, common ninebark.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
Sk*. Saprists and Aquents					
Sm---------- Sebewa	Silky dogwood-----	---	White spruce------	Eastern white pine	---
SuA, SuB, SuC2, SuD2---------- Sisson	Gray dogwood------	Common ninebark, silky dogwood.	White spruce------	Eastern white pine, red pine.	---
ThB, ThC2, ThD2, ThE2, TrD3------- Theresa	Gray dogwood------	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
Ud*. Udorthents					
Uf*. Udifluvents					

* 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
AcA Ackmore	Severe: floods, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, shrink-swell.	Moderate: wetness.
Ar Adrian Variant	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.	Severe: wetness, floods.
AsA, AsB Ashippun	Severe: wetness.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Severe: frost action, low strength.	Moderate: wetness.
BsA Brookston	Severe: wetness, floods.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, low strength, floods.	Severe: wetness, floods.
CcB Casco	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
CcC2 Casco	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
CcD2 Casco	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CdB Channahon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
CdC2 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.
CdD2 Channahon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: thin layer, slope.
ChB Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: too sandy.
ChC Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: too sandy, slope.
Co Colwood	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, low strength, floods.	Severe: wetness, floods.
DdA Dodge	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, frost action.	Slight.
DdB Dodge	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: low strength, frost action.	Slight.
DdC2 Dodge	Moderate: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope, shrink-swell, low strength.	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
EbA---------- Elburn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
Ev---------- Elvers	Severe: wetness, floods, excess humus.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, frost action.	Severe: floods, wetness.
FoE2---------- Fox	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
FsA---------- Fox	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.	Slight.
FsB---------- Fox	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.	Slight.
FsC2---------- Fox	Severe: cutbanks cave.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.	Moderate: slope.
FsD2---------- Fox	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Fu*. Fluvaquents						
FxC3---------- Fox	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.	Moderate: too clayey, slope.
Gb---------- Granby Variant	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
HnB---------- Hochheim	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
HnC2---------- Hochheim	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, frost action.	Moderate: slope.
HnD2, HnE2, HoD3-- Hochheim	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hu, Hw---------- Houghton	Severe: wetness, floods, excess humus.	Severe: wetness, floods, low strength.	Severe: wetness, low strength, floods.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: excess humus, wetness, floods.
IoA---------- Ionia	Severe: wetness, cutbanks cave.	Moderate: wetness, shrink-swell, low strength.	Severe: wetness.	Moderate: wetness, shrink-swell, low strength.	Moderate: frost action, low strength.	Slight.
JuA, JuB---------- Juneau	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.	Moderate: floods.

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
Ke Keowns	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
KlA, KlB Kibbie	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.	Moderate: wetness.
KrB Kidder	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
KrC2 Kidder	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
KrD2, KrE2 Kidder	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KwA Knowles	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: frost action.	Moderate: thin layer.
KwB Knowles	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: frost action.	Moderate: thin layer.
KwC2 Knowles	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: depth to rock.	Severe: slope.	Severe: frost action.	Moderate: slope, thin layer.
KxA, KxB Knowles Variant	Severe: wetness, depth to rock, floods.	Severe: wetness, floods.	Severe: wetness, depth to rock, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.	Moderate: wetness, floods, thin layer.
LmA, LmB Lamartine	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.	Moderate: wetness, floods.
LrB LeRoy	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: frost action, low strength.	Slight.
LrC2 LeRoy	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, low strength.	Moderate: slope.
LrD2, LrE2 LeRoy	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
LvB Lomira	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
LvC2 Lomira	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action, low strength.	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
MdB---------- Markesan	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: frost action.	Slight.
MdC2---------- Markesan	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
MoA---------- Mayville	Moderate: wetness.	Moderate: low strength, shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: low strength, shrink-swell.	Severe: frost action, low strength.	Slight.
MoB---------- Mayville	Moderate: wetness.	Moderate: low strength, shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
MoC---------- Mayville	Moderate: wetness, slope.	Moderate: shrink-swell, slope, low strength.	Moderate: wetness, shrink-swell, slope.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
MrB---------- McHenry	Slight---------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: slope, shrink-swell, low strength.	Moderate: low strength, frost action.	Slight.
MrC2---------- McHenry	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
MrD2---------- McHenry	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
MsB---------- Mendota	Slight---------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action.	Slight.
MsC2---------- Mendota	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action.	Moderate: slope.
MyB---------- Miami	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.	Slight.
MyC2---------- Miami	Moderate: slope, too clayey.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.	Moderate: slope.
MyD2, MzD3, MzE3-- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
NeB---------- Neda	Moderate: wetness.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, low strength, slope.	Severe: low strength.	Slight.
NeC2---------- Neda	Moderate: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: wetness, slope.	Severe: slope.	Severe: low strength.	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
NeD2, NeE2 Neda	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
NvB Neda Variant	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: thin layer.
NvC2 Neda Variant	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: slope, thin layer.
NxA, NxB Nenno	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Moderate: wetness, floods.
Ot Otter	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
Pa Palms	Severe: wetness, excess humus, floods.	Severe: wetness, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, excess humus.
Ph Pella	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.	Severe: wetness.
Pk Pella Variant	Severe: wetness, depth to rock, floods.	Severe: wetness, floods.	Severe: wetness, depth to rock, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.	Severe: wetness.
Pn*. Pits						
PsA Plano	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
PsB Plano	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: frost action, low strength.	Slight.
PtA Plano	Moderate: wetness.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
PuB Puchyan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: too sandy.
RcE*: Channahon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: thin layer, slope.
Rock outcrop.						
RxC2*: Rodman	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: small stones.

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
RxC2*: Casco	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
RxD2*: Rodman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
Casco	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ScA St. Charles	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
ScB St. Charles	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
ScC2 St. Charles	Moderate: slope.	Moderate: shrink-swell, slope, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
SdA St. Charles	Moderate: wetness.	Moderate: shrink-swell, low strength.	Severe: wetness.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
SeA St. Charles	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.	Severe: frost action, low strength.	Slight.
SeB St. Charles	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
Sk*. Saprists and Aquents						
Sm Sebewa	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action.	Severe: wetness, floods.
SuA Sisson	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.	Slight.
SuB Sisson	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Severe: low strength.	Slight.
SuC2 Sisson	Severe: cutbanks cave.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Severe: low strength.	Moderate: slope.
SuD2 Sisson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.

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
ThB---------- Theresa	Slight---------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.	Slight.
ThC2---------- Theresa	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.	Moderate: slope.
ThD2, ThE2, TrD3-- Theresa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Ud*. Udorthents						
Uf*. Udifluvents						

* 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," and "fair." 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
AcA Ackmore	Severe: percs slowly, floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: too clayey.
Ar Adrian Variant	Severe: wetness, floods.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Poor: wetness, excess humus, hard to pack.
AsA, AsB Ashippun	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, floods.	Good.
BsA Brookston	Severe: wetness, percs slowly, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
CcB Casco	Slight*	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
CcC2 Casco	Moderate*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope.
CcD2 Casco	Severe*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
CdB Channahon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
CdC2 Channahon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
CdD2 Channahon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, slope.
ChB Chelsea	Slight*	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
ChC Chelsea	Moderate*: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Co Colwood	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
DdA Dodge	Slight	Moderate: seepage.	Slight	Slight	Fair: small stones.
DdB Dodge	Slight	Moderate: slope, seepage.	Slight	Slight	Fair: small stones.
DdC2 Dodge	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: small stones, slope.

See footnotes 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
EbA---------- Elburn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
Ev---------- Elvers	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
FoE2---------- Fox	Severe*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: small stones, slope.
FsA, FsB---------- Fox	Slight*----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
FsC2---------- Fox	Moderate*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
FsD2---------- Fox	Severe*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: small stones, slope.
Fu. Fluvaquents					
FxC3---------- Fox	Moderate*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Gb---------- Granby Variant	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Poor: wetness, too sandy.
HnB---------- Hochheim	Slight**----------	Moderate: seepage.	Slight----------	Slight----------	Fair: small stones.
HnC2---------- Hochheim	Moderate**: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: slope, small stones.
HnD2---------- Hochheim	Severe**: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
HnE2---------- Hochheim	Severe**: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
HoD3---------- Hochheim	Severe**: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Hu, Hw---------- Houghton	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: hard to pack, wetness.
IoA---------- Ionia	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Fair: thin layer, too clayey.
JuA---------- Juneau	Severe: floods.	Moderate: seepage, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
JuB---------- Juneau	Severe: floods.	Moderate: seepage, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Ke---------- Keowns	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Poor: wetness.

See footnotes 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
KlA, KlB---------- Kibbie	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
KrB---------- Kidder	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
KrC2---------- Kidder	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope, small stones.
KrD2, KrE2---------- Kidder	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Fair: slope, small stones.
KwA, KwB---------- Knowles	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Poor: area reclaim.
KwC2---------- Knowles	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: area reclaim.
KxA, KxB---------- Knowles Variant	Severe: wetness, depth to rock, floods.	Severe: wetness, depth to rock, floods.	Severe: wetness, depth to rock, floods.	Severe: floods, wetness.	Poor: area reclaim.
LmA, LmB---------- Lamartine	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Fair: small stones.
LrB---------- LeRoy	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Fair: small stones.
LrC2---------- LeRoy	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: small stones, slope.
LrD2, LrE2---------- LeRoy	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
LvB---------- Lomira	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Fair: small stones.
LvC2---------- Lomira	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: small stones, slope.
MdB---------- Markesan	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Fair: small stones.
MdC2---------- Markesan	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: small stones, slope.
MoA, MoB---------- Mayville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: small stones.
MoC---------- Mayville	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: small stones, slope.
MrB---------- McHenry	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.

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
MrC2---------- McHenry	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope, small stones.
MrD2---------- McHenry	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
MsB---------- Mendota	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Fair: small stones.
MsC2---------- Mendota	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: small stones, slope.
MyB---------- Miami	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
MyC2---------- Miami	Moderate: percs slowly, slope.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
MyD2, MzD3, MzE3---- Miami	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
NeB---------- Neda	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Slight----------	Good.
NeC2---------- Neda	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope.	Fair: slope.
NeD2---------- Neda	Severe: wetness, slope.	Severe: slope, wetness.	Moderate: wetness, slope.	Severe: slope.	Poor: slope.
NeE2---------- Neda	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
NvB---------- Neda Variant	Severe: percs slowly.	Moderate: depth to rock, slope.	Severe: too clayey, depth to rock.	Moderate: wetness.	Poor: area reclaim.
NvC2---------- Neda Variant	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope, wetness.	Poor: area reclaim.
NxA, NxB---------- Nenno	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: small stones.
Ot---------- Otter	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Pa---------- Palms	Severe: wetness, floods, subsides.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, seepage.	Poor: excess humus, wetness.
Ph---------- Pella	Severe: wetness, floods.	Severe: wetness, floods.	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
Pk---------- Pella Variant	Severe: wetness, depth to rock, floods.	Severe: wetness, depth to rock, floods.	Severe: wetness, depth to rock, floods.	Severe: wetness, floods.	Poor: wetness, area reclaim.
Pn. Pits					
PsA---------- Plano	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Fair: too clayey.
PsB---------- Plano	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Fair: too clayey.
PtA---------- Plano	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
PuB---------- Puchyan	Slight***--------	Severe: seepage.	Slight----------	Slight----------	Fair: thin layer.
RcE: Channahon----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, slope.
Rock outcrop.					
RxC2: Rodman----------	Moderate*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage, small stones.
Casco----------	Moderate*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope.
RxD2: Rodman----------	Severe*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: too sandy, slope, small stones.
Casco----------	Severe*: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
ScA---------- St. Charles	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Fair: too clayey.
ScB---------- St. Charles	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Fair: too clayey.
ScC2---------- St. Charles	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: too clayey, slope.
SdA---------- St. Charles	Severe: wetness.	Moderate: wetness, seepage.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
SeA, SeB---------- St. Charles	Slight*----------	Severe: seepage.	Severe: seepage.	Slight----------	Fair: too clayey, small stones.

See footnotes 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
Sk. Saprists and Aquents					
Sm Sebewa	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness, small stones.
SuA Sisson	Slight	Moderate: seepage.	Slight	Slight	Good.
SuB Sisson	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
SuC2 Sisson	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
SuD2 Sisson	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
ThB Theresa	Slight**	Moderate: slope, seepage.	Slight	Slight	Fair: small stones.
ThC2 Theresa	Moderate**: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, small stones.
ThD2, ThE2, TrD3 Theresa	Severe** slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Ud. Udorthents					
Uf. Udifluvents					

* Pollution of ground water is a hazard because of the rapid or very rapid permeability.

** The moderately slow permeability in some areas is a severe limitation.

*** In the moderately well drained areas, wetness is a severe limitation.

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
AcA Ackmore	Poor: low strength, shrink-swell, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ar Adrian Variant	Poor: excess humus, wetness, frost action.	Unsuited	Unsuited	Poor: wetness.
AsA, AsB Ashippun	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
BsA Brookston	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
CcB Casco	Good	Good	Good	Fair: thin layer.
CcC2 Casco	Good	Good	Good	Fair: thin layer, slope.
CcD2 Casco	Fair: slope.	Good	Good	Poor: slope.
CdB, CdC2 Channahon	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
CdD2 Channahon	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
ChB, ChC Chelsea	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Co Colwood	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
DdA, DdB Dodge	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
DdC2 Dodge	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
EbA Elburn	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ev Elvers	Poor: wetness.	Unsuited: excess fines, excess humus.	Unsuited: excess fines, excess humus.	Poor: wetness.
FoE2 Fox	Fair: slope.	Good	Good	Poor: slope.
FsA, FsB Fox	Good	Good	Good	Fair: thin layer.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FsC2---- Fox	Good	Good	Good	Fair: thin layer, slope.
FsD2---- Fox	Fair: slope.	Good	Good	Poor: slope.
Fu*. Fluvaquents				
FxC3---- Fox	Good	Good	Good	Fair: too clayey, slope.
Gb---- Granby Variant	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
HnB, HnC2---- Hochheim	Fair: low strength.	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer.
HnD2, HnE2, HoD3---- Hochheim	Fair: low strength, slope.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope.
Hu, Hw---- Houghton	Poor: wetness. low strength.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
IoA---- Ionia	Fair: wetness.	Good	Good	Good.
JuA, JuB---- Juneau	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ke---- Keowns	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
KlA, KlB---- Kibbie	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
KrB---- Kidder	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
KrC2---- Kidder	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
KrD2, KrE2---- Kidder	Fair: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
KwA, KwB---- Knowles	Poor: area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
KwC2---- Knowles	Poor: area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer, area reclaim.
KxA, KxB---- Knowles Variant	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
LmA, LmB---- Lamartine	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
LrB---- LeRoy	Fair: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LrC2---------- LeRoy	Fair: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: slope, thin layer.
LrD2, LrE2---------- LeRoy	Fair: slope, low strength.	Poor: excess fines.	Poor: excess fines.	Poor: slope.
LvB---------- Lomira	Fair: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
LvC2---------- Lomira	Fair: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: slope, thin layer.
MdB---------- Markesan	Fair: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
MdC2---------- Markesan	Fair: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: slope, thin layer.
MoA, MoB---------- Mayville	Good----------	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
MoC---------- Mayville	Good----------	Poor: excess fines.	Poor: excess fines.	Fair: thin layer, slope.
MrB---------- McHenry	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
MrC2---------- McHenry	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
MrD2---------- McHenry	Fair: low strength, slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
MsB---------- Mendota	Good----------	Poor: excess fines.	Poor: excess fines.	Good.
MsC2---------- Mendota	Good----------	Poor: excess fines.	Poor: excess fines.	Fair: slope.
MyB---------- Miami	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
MyC2---------- Miami	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
MyD2, MzD3, MzE3------ Miami	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
NeB---------- Neda	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
NeC2---------- Neda	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
NeD2, NeE2---------- Neda	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
NvB---------- Neda Variant	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
NvC2---------- Neda Variant	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope, area reclaim.
NxA, NxB---------- Nenn	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ot---------- Otter	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Pa---------- Palms	Poor: wetness, low strength.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
Ph---------- Pella	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Pk---------- Pella Variant	Poor: wetness, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Pn*. Pits				
PsA, PsB, PtA--------- Plano	Poor: low strength.	Unsuited----------	Unsuited----------	Fair: thin layer.
PuB---------- Puchyan	Fair: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
RcE*: Channahon----------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
Rock outcrop.				
RxC2*: Rodman----------	Good----------	Good----------	Good----------	Poor: small stones.
Casco----------	Good----------	Good----------	Good----------	Fair: thin layer, slope.
RxD2*: Rodman----------	Fair: slope.	Good----------	Good----------	Poor: small stones, slope.
Casco----------	Fair: slope.	Good----------	Good----------	Poor: slope.
ScA, ScB---------- St. Charles	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
ScC2---------- St. Charles	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SdA---------- St. Charles	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
SeA, SeB---------- St. Charles	Poor: low strength.	Good----------	Good----------	Fair: thin layer.
Sk*. Saprists and Aquents				
Sm---------- Sebewa	Poor: wetness.	Good----------	Good----------	Poor: wetness.
SuA, SuB---------- Sisson	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
SuC2---------- Sisson	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
SuD2---------- Sisson	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
ThB---------- Theresa	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
ThC2---------- Theresa	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
ThD2, ThE2, TrD3------ Theresa	Fair: low strength, slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
Ud*. Udorthents				
Uf*. Udifluvents				

* 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	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AcA---- Ackmore	Favorable------	Hard to pack---	Slow refill----	Floods, frost action.	Not needed-----	Wetness.
Ar---- Adrian Variant	Seepage, excess humus.	Compressible, low strength, hard to pack.	Slow refill----	Floods, wetness, frost action.	Not needed-----	Not needed.
AsA---- Ashippun	Seepage--------	Favorable------	Slow refill----	Frost action---	Not needed-----	Wetness.
AsB---- Ashippun	Seepage--------	Favorable------	Slow refill----	Frost action---	Wetness--------	Wetness.
BsA---- Brookston	Favorable------	Wetness--------	Slow refill----	Floods, frost action.	Not needed-----	Wetness.
CcB---- Casco	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy------	Droughty.
CcC2---- Casco	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy------	Droughty, slope.
CcD2---- Casco	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy, slope.	Droughty, slope.
CdB---- Channahon	Depth to rock--	Thin layer-----	No water-------	Not needed-----	Depth to rock	Erodes easily, droughty, rooting depth.
CdC2---- Channahon	Depth to rock--	Thin layer-----	No water-------	Not needed-----	Depth to rock	Slope, erodes easily, droughty.
CdD2---- Channahon	Depth to rock, slope.	Thin layer-----	No water-------	Not needed-----	Depth to rock, slope.	Slope, erodes easily, droughty.
ChB---- Chelsea	Seepage--------	Piping, seepage.	No water-------	Not needed-----	Complex slope, too sandy, soil blowing.	Droughty.
ChC---- Chelsea	Seepage--------	Piping, seepage.	No water-------	Not needed-----	Too sandy, soil blowing.	Slope, droughty.
Co---- Colwood	Seepage--------	Low strength, piping, erodes easily.	Slow refill----	Cutbanks cave, wetness.	Wetness--------	Wetness.
DdA---- Dodge	Seepage--------	Piping---------	No water-------	Not needed-----	Not needed-----	Erodes easily.
DdB---- Dodge	Seepage--------	Piping---------	No water-------	Not needed-----	Favorable------	Erodes easily.
DdC2---- Dodge	Seepage, slope.	Piping---------	No water-------	Not needed-----	Favorable------	Slope, erodes easily.
EbA---- Elburn	Seepage--------	Wetness--------	Slow refill----	Frost action---	Not needed-----	Wetness.
Ev---- Elvers	Seepage--------	Seepage, excess humus.	Slow refill----	Floods, frost action.	Not needed-----	Wetness, erodes easily.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
FoE2---------- Fox	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy, slope.	Slope.
FsA---------- Fox	Seepage--------	Seepage--------	No water-------	Not needed-----	Not needed-----	Favorable.
FsB---------- Fox	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy------	Favorable.
FsC2---------- Fox	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy------	Slope.
FsD2---------- Fox	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy, slope.	Slope.
Fu* Fluvaquents						
FxC3---------- Fox	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy------	Slope.
Gb---------- Granby Variant	Seepage--------	Seepage, piping, wetness.	Favorable------	Wetness, floods, cutbanks cave.	Not needed-----	Wetness.
HnB---------- Hochheim	Seepage--------	Favorable------	No water-------	Not needed-----	Complex slope	Favorable.
HnC2---------- Hochheim	Slope, seepage.	Favorable------	No water-------	Not needed-----	Complex slope	Slope.
HnD2, HnE2, HoD3-- Hochheim	Slope, seepage.	Favorable------	No water-------	Not needed-----	Slope----------	Slope.
Hu, Hw---------- Houghton	Seepage--------	Excess humus, low strength.	Favorable------	Poor outlets, frost action.	Not needed-----	Wetness.
IoA---------- Ionia	Seepage--------	Seepage, wetness.	Deep to water, slow refill.	Not needed-----	Not needed-----	Favorable.
JuA---------- Juneau	Seepage--------	Favorable------	Deep to water--	Not needed-----	Not needed-----	Erodes easily.
JuB---------- Juneau	Seepage--------	Favorable------	Deep to water--	Not needed-----	Favorable------	Erodes easily.
Ke---------- Keowns	Seepage--------	Wetness, piping.	Favorable------	Floods, frost action.	Not needed-----	Wetness.
KlA---------- Kibbie	Seepage--------	Piping, wetness.	Deep to water, slow refill.	Cutbanks cave, frost action.	Not needed-----	Favorable.
KlB---------- Kibbie	Seepage--------	Piping, wetness.	Deep to water, slow refill.	Cutbanks cave, frost action.	Favorable------	Favorable.
KrB---------- Kidder	Seepage--------	Favorable------	No water-------	Not needed-----	Complex slope	Favorable.
KrC2---------- Kidder	Seepage--------	Favorable------	No water-------	Not needed-----	Complex slope	Slope.
KrD2, KrE2-------- Kidder	Slope, seepage.	Favorable------	No water-------	Not needed-----	Slope----------	Slope.
KwA---------- Knowles	Depth to rock, seepage.	Thin layer-----	No water-------	Not needed-----	Not needed-----	Depth to rock.
KwB---------- Knowles	Depth to rock, seepage.	Thin layer-----	No water-------	Not needed-----	Favorable------	Depth to rock.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
KwC2--Knowles	Depth to rock, seepage.	Thin layer	No water	Not needed	Favorable	Slope, depth to rock.
KxA--Knowles Variant	Depth to rock, seepage.	Wetness, thin layer.	Slow refill	Frost action, floods.	Not needed	Wetness, depth to rock.
KxB--Knowles Variant	Depth to rock, seepage.	Wetness, thin layer.	Slow refill	Frost action, floods.	Wetness	Wetness, depth to rock.
LmA--Lamartine	Seepage	Favorable	Favorable	Frost action, floods.	Not needed	Wetness.
LmB--Lamartine	Seepage	Piping, wetness.	Deep to water, slow refill.	Frost action, floods.	Wetness, erodes easily.	Wetness, erodes easily.
LrB--LeRoy	Seepage	Favorable	No water	Not needed	Complex slope	Erodes easily.
LrC2--LeRoy	Seepage	Favorable	No water	Not needed	Complex slope	Slope, erodes easily.
LrD2, LrE2--LeRoy	Seepage, slope.	Favorable	No water	Not needed	Slope	Slope, erodes easily.
LvB--Lomira	Seepage	Favorable	No water	Not needed	Complex slope	Erodes easily.
LvC2--Lomira	Seepage	Favorable	No water	Not needed	Complex slope	Slope, erodes easily.
MdB--Markesan	Seepage	Favorable	No water	Not needed	Favorable	Favorable.
MdC2--Markesan	Seepage	Favorable	No water	Not needed	Favorable	Slope.
MoA--Mayville	Seepage	Piping	Deep to water, slow refill.	Not needed	Not needed	Erodes easily.
MoB--Mayville	Seepage	Piping	Deep to water, slow refill.	Not needed	Favorable	Erodes easily.
MoC--Mayville	Seepage	Piping	Deep to water, slow refill.	Not needed	Favorable	Slope, erodes easily.
MrB--McHenry	Seepage	Favorable	No water	Not needed	Favorable	Erodes easily.
MrC2--McHenry	Seepage	Favorable	No water	Not needed	Favorable	Erodes easily, slope.
MrD2--McHenry	Seepage	Favorable	No water	Not needed	Slope	Erodes easily, slope.
MsB--Mendota	Seepage	Favorable	No water	Not needed	Complex slope	Favorable.
MsC2--Mendota	Seepage	Favorable	No water	Not needed	Complex slope	Slope.
MyB--Miami	Seepage	Favorable	No water	Not needed	Complex slope	Erodes easily.
MyC2--Miami	Seepage	Favorable	No water	Not needed	Complex slope	Slope, erodes easily.
MyD2, MzD3, MzE3--Miami	Seepage	Favorable	No water	Not needed	Slope	Slope, erodes easily.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
NeB---------- Neda	Seepage--------	Favorable------	Deep to water, slow refill.	Not needed-----	Complex slope	Favorable.
NeC2---------- Neda	Seepage--------	Favorable------	Deep to water, slow refill.	Not needed-----	Complex slope	Slope.
NeD2---------- Neda	Slope, seepage.	Favorable------	Deep to water, slow refill.	Not needed-----	Slope----------	Slope.
NeE2---------- Neda	Slope, seepage.	Favorable------	No water-------	Not needed-----	Slope----------	Slope.
NvB---------- Neda Variant	Depth to rock	Thin layer, hard to pack.	Slow refill----	Not needed-----	Percs slowly---	Percs slowly, erodes easily.
NvC2---------- Neda Variant	Slope, depth to rock.	Thin layer, hard to pack.	Slow refill----	Not needed-----	Slope, percs slowly.	Slope, percs slowly, erodes easily.
NxA---------- Nenno	Seepage--------	Seepage--------	Slow refill----	Frost action---	Not needed-----	Wetness.
NxB---------- Nenno	Seepage--------	Seepage--------	Slow refill----	Frost action---	Wetness--------	Wetness.
Ot---------- Otter	Seepage--------	Piping, wetness.	Slow refill----	Floods, frost action.	Not needed-----	Wetness.
Pa---------- Palms	Seepage--------	Excess humus, wetness.	Favorable------	Floods, frost action.	Not needed-----	Wetness.
Ph---------- Pella	Seepage--------	Wetness--------	Slow refill----	Floods, frost action.	Not needed-----	Wetness.
Pk---------- Pella Variant	Depth to rock	Thin layer, wetness.	Favorable------	Depth to rock, floods, frost action.	Not needed-----	Wetness, depth to rock.
Pn*. Pits						
PsA, PsB---------- Plano	Seepage--------	Shrink-swell, low strength.	No water-------	Not needed-----	Favorable------	Favorable.
PtA---------- Plano	Seepage--------	Shrink-swell, low strength.	Deep to water, slow refill.	Not needed-----	Favorable------	Favorable.
PuB---------- Puchyan	Seepage--------	Piping---------	No water-------	Not needed-----	Too sandy, soil blowing, complex slope.	Favorable.
RcE*: Channahon--------	Depth to rock, slope.	Thin layer-----	No water-------	Not needed-----	Depth to rock, slope.	Slope, erodes easily, droughty.
Rock outcrop.						
RxC2*: Rodman----------	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy------	Slope, droughty.
Casco----------	Seepage--------	Seepage--------	No water-------	Not needed-----	Too sandy------	Droughty, slope.
RxD2*: Rodman----------	Seepage--------	Seepage--------	No water-------	Not needed-----	Slope, too sandy.	Slope, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
RxD2*: Casco	Seepage	Seepage	No water	Not needed	Too sandy, slope.	Droughty, slope.
ScA--St. Charles	Seepage	Favorable	No water	Not needed	Not needed	Erodes easily.
ScB--St. Charles	Seepage	Favorable	No water	Not needed	Slope	Erodes easily.
ScC2--St. Charles	Seepage	Favorable	No water	Not needed	Slope	Erodes easily, slope.
SdA--St. Charles	Seepage	Favorable	Deep to water, slow refill.	Not needed	Not needed	Erodes easily.
SeA--St. Charles	Seepage	Favorable	No water	Not needed	Not needed	Erodes easily.
SeB--St. Charles	Seepage	Favorable	No water	Not needed	Erodes easily	Erodes easily.
Sk*. Saprists and Aquents						
Sm--Sebewa	Seepage	Seepage, wetness.	Slow refill	Frost action	Not needed	Wetness.
SuA--Sisson	Seepage	Favorable	No water	Not needed	Not needed	Favorable.
SuB--Sisson	Seepage	Favorable	No water	Not needed	Soil blowing	Favorable.
SuC2--Sisson	Seepage	Favorable	No water	Not needed	Soil blowing	Slope.
SuD2--Sisson	Seepage	Favorable	No water	Not needed	Soil blowing, slope.	Slope.
ThB--Theresa	Seepage	Piping	No water	Not needed	Erodes easily	Erodes easily.
ThC2--Theresa	Seepage	Piping	No water	Not needed	Erodes easily	Slope, erodes easily.
ThD2, ThE2, TrD3--Theresa	Slope, seepage.	Piping	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
Ud*. Udorthents						
Uf*. Udifluvents						

* 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	Golf fairways
AcA Ackmore	Severe: floods, wetness.	Moderate: wetness.	Moderate: floods, percs slowly, wetness.	Moderate: wetness.	Moderate: wetness.
Ar Adrian Variant	Severe: floods, wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, floods.	Severe: wetness, excess humus.	Severe: wetness, floods.
AsA, AsB Ashippun	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BsA Brookston	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
CcB Casco	Slight	Slight	Moderate: slope.	Slight	Slight.
CcC2 Casco	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CcD2 Casco	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
CdB Channahon	Slight	Slight	Severe: depth to rock.	Slight	Severe: thin layer.
CdC2 Channahon	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight	Severe: thin layer.
CdD2 Channahon	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Moderate: slope.	Severe: thin layer, slope.
ChB Chelsea	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: too sandy.
ChC Chelsea	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: too sandy, slope.
Co Colwood	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.
DdA Dodge	Slight	Slight	Slight	Slight	Slight.
DdB Dodge	Slight	Slight	Moderate: slope.	Slight	Slight.
DdC2 Dodge	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
EbA Elburn	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ev Elvers	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FoE2---------- Fox	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
FsA---------- Fox	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
FsB---------- Fox	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
FsC2---------- Fox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
FsD2---------- Fox	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Fu*. Fluvaquents					
FxC3---------- Fox	Moderate: too clayey, slope.	Moderate: too clayey, slope.	Severe: slope.	Moderate: too clayey.	Moderate: too clayey, slope.
Gb---------- Granby Variant	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
HnB---------- Hochheim	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
HnC2---------- Hochheim	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
HnD2, HnE2---------- Hochheim	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
HoD3---------- Hochheim	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.
Hu, Hw---------- Houghton	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, floods.
IoA---------- Ionia	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
JuA, JuB---------- Juneau	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Moderate: floods.
Ke---------- Keowns	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
KlA, KlB---------- Kibbie	Severe: wetness, floods.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
KrB---------- Kidder	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
KrC2---------- Kidder	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
KrD2, KrE2---------- Kidder	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: 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	Golf fairways
KwA---------- Knowles	Slight----------	Slight----------	Moderate: depth to rock.	Slight----------	Moderate: thin layer.
KwB---------- Knowles	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight----------	Moderate: thin layer.
KwC2---------- Knowles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope, thin layer.
KxA, KxB---------- Knowles Variant	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods, thin layer.
LmA, LmB---------- Lamartine	Severe: wetness, floods.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
LrB---------- LeRoy	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
LrC2---------- LeRoy	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
LrD2, LrE2---------- LeRoy	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
LvB---------- Lomira	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
LvC2---------- Lomira	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
MdB---------- Markesan	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
MdC2---------- Markesan	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
MoA---------- Mayville	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
MoB---------- Mayville	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
MoC---------- Mayville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
MrB---------- McHenry	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
MrC2---------- McHenry	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
MrD2---------- McHenry	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
MsB---------- Mendota	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
MsC2---------- Mendota	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
MyB---------- Miami	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MyC2---------- Miami	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
MyD2---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
MzD3, MzE3---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.
NeB---------- Neda	Moderate: percs slowly.	Slight----------	Moderate: percs slowly, slope.	Slight----------	Slight.
NeC2---------- Neda	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
NeD2, NeE2---------- Neda	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
NvB---------- Neda Variant	Moderate: percs slowly.	Slight----------	Moderate: slope, depth to rock, percs slowly.	Slight----------	Moderate: thin layer.
NvC2---------- Neda Variant	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope, thin layer.
NxA, NxB---------- Nenno	Severe: wetness, floods.	Moderate: wetness, floods.	Moderate: wetness, floods.	Moderate: wetness, floods.	Moderate: wetness, floods.
Ot---------- Otter	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
Pa---------- Palms	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.
Ph---------- Pella	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Pk---------- Pella Variant	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.
Pn*. Pits					
PsA---------- Plano	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
PsB---------- Plano	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
PtA---------- Plano	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
PuB---------- Puchyan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RcE*:					
Channahon	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Moderate: slope.	Severe: thin layer, slope.
Rock outcrop.					
RxC2*:					
Rodman	Moderate: slope.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Severe: small stones.
Casco	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
RxD2*:					
Rodman	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: small stones, slope.	Severe: slope, small stones.
Casco	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
ScA St. Charles	Slight	Slight	Slight	Slight	Slight.
ScB St. Charles	Slight	Slight	Moderate: slope.	Slight	Slight.
ScC2 St. Charles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
SdA, SeA St. Charles	Slight	Slight	Slight	Slight	Slight.
SeB St. Charles	Slight	Slight	Moderate: slope.	Slight	Slight.
Sk*. Saprists and Aquents					
Sm Sebewa	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
SuA Sisson	Slight	Slight	Slight	Slight	Slight.
SuB Sisson	Slight	Slight	Moderate: slope.	Slight	Slight.
SuC2 Sisson	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
SuD2 Sisson	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
ThB Theresa	Slight	Slight	Moderate: slope.	Slight	Slight.
ThC2 Theresa	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
ThD2, ThE2, TrD3 Theresa	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Ud*. Udorthents					
Uf*. Udifluvents					

* 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
AcA---------- Ackmore	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ar---------- Adrian Variant	Good	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
AsA, AsB---------- Ashippun	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BsA---------- Brookston	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
CcB, CcC2---------- Casco	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
CcD2---------- Casco	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
CdB, CdC2, CdD2---- Channahon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
ChB---------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
ChC---------- Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Co---------- Colwood	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Good.
DdA, DdB---------- Dodge	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
DdC2---------- Dodge	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
EbA---------- Elburn	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ev---------- Elvers	Good	Fair	Good	Good	Good	Good	Good	Good	Good	Good.
FoE2---------- Fox	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
FsA, FsB---------- Fox	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FsC2, FsD2, FxC3--- Fox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fu*. Fluvaquents										
Gb---------- Granby Variant	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Good	Very poor.
HnB---------- Hochheim	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
HnC2---------- Hochheim	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	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
HnD2---------- Hochheim	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
HnE2---------- Hochheim	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
HoD3---------- Hochheim	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Hu---------- Houghton	Good	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
Hw---------- Houghton	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
IoA---------- Ionia	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
JuA, JuB---------- Juneau	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ke---------- Keowns	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
KlA---------- Kibbie	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
KlB---------- Kibbie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Fair.
KrB---------- Kidder	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
KrC2---------- Kidder	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KrD2---------- Kidder	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KrE2---------- Kidder	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KwA, KwB---------- Knowles	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
KwC2---------- Knowles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
KxA, KxB---------- Knowles Variant	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair.
LmA---------- Lamartine	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
LmB---------- Lamartine	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
LrB---------- LeRoy	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LrC2---------- LeRoy	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LrD2---------- LeRoy	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
LrE2---------- LeRoy	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
LvB---------- Lomira	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LvC2---------- Lomira	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MdB---------- Markesan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MdC2---------- Markesan	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MoA, MoB---------- Mayville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MoC---------- Mayville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MrB---------- McHenry	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MrC2, MrD2--------- McHenry	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MsB---------- Mendota	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.
MsC2---------- Mendota	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.
MyB---------- Miami	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MyC2---------- Miami	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MyD2, MzD3, MzE3--- Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
NeB---------- Neda	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NeC2---------- Neda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NeD2---------- Neda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NeE2---------- Neda	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
NvB---------- Neda Variant	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
NvC2---------- Neda Variant	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NxA---------- Nenno	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
NxB---------- Nenno	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	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
Ot---------- Otter	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
Pa---------- Palms	Good	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Ph---------- Pella	Good	Good	Good	Fair	Poor	Fair	Fair	Good	Fair	Fair.
Pk---------- Pella Variant	Fair	Good	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
Pn*. Pits										
PsA, PsB, PtA------ Plano	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PuB---------- Puchyan	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RcE*:										
Channahon---------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
RxC2*:										
Rodman----------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Casco----------	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
RxD2*:										
Rodman----------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Casco----------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
ScA, ScB---------- St. Charles	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
ScC2---------- St. Charles	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
SdA---------- St. Charles	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
SeA, SeB---------- St. Charles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sk*. Saprists and Aquents										
Sm---------- Sebewa	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
SuA, SuB---------- Sisson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SuC2---------- Sisson	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
SuD2---------- Sisson	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	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
ThB---------- Theresa	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ThC2---------- Theresa	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ThD2---------- Theresa	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ThE2---------- Theresa	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
TrD3---------- Theresa	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ud*. Udorthents										
Uf*. Udifluvents										

* 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		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AcA---------- Ackmore	0-26	Silt loam-------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-50	8-20
	26-60	Silty clay loam, silt loam.	CH, CL, MH	A-7, A-6	0	100	100	95-100	85-100	35-65	15-30
Ar---------- Adrian variant	0-16	Sapric material	Pt	---	0	---	---	---	---	---	---
	16-24	Coprogenous earth.	OH, OL	---	0	---	---	---	---	---	---
	24-60	Stratified silt to fine sand.	ML, CL-ML, CL	A-4	0	100	100	100	60-70	<20	NP-10
AsA, AsB---------- Ashippun	0-11	Silt loam-------	ML	A-4	0	100	100	90-100	70-80	20-30	1-5
	11-20	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-50	10-30
	20-26	Clay loam, shaly clay loam, loam.	CL	A-4, A-6, A-7	0-3	75-95	75-95	70-90	60-80	30-50	10-30
	26-60	Loam, shaly loam	CL	A-4, A-6	0-10	75-95	75-95	70-90	50-60	25-35	10-15
BsA---------- Brookston	0-12	Silt loam-------	CL	A-4, A-6	0	98-100	98-100	85-100	60-90	22-40	8-18
	12-36	Clay loam, silty clay loam, loam	CL, CH	A-6, A-7	0	98-100	85-100	75-95	60-85	36-52	18-30
	36-60	Loam, sandy loam, clay loam.	CL	A-4, A-6	0-3	90-100	85-95	78-90	55-70	22-30	7-15
CcB, CcC2, CcD2---- Casco	0-11	Loam----------	ML, GM-GC, SM-SC, CL	A-4	0	60-100	50-100	50-100	40-75	20-30	3-10
	11-20	Clay loam, loam, sandy clay loam.	SC, CL, GC	A-6, A-7	0-5	60-100	55-100	55-90	35-70	25-45	11-25
	20-60	Sand and gravel	GP, SP, GP-GM, SP-SM	A-1, A-3, A-2	0-10	30-100	30-90	10-90	3-10	---	NP
CdB, CdC2, CdD2---- Channahon	0-13	Silt loam-------	CL	A-6, A-4	0-20	95-100	95-100	85-100	65-90	21-38	7-18
	13-18	Loam, clay loam, silty clay loam.	CL	A-6, A-7	0-20	95-100	90-100	85-100	50-85	30-46	15-25
	18-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ChB, ChC---------- Chelsea	0-9	Loamy fine sand	SM	A-2-4	0	100	100	65-80	10-35	---	NP
	9-60	Fine sand-------	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
Co---------- Colwood	0-16	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	16-28	Loam, silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	100	100	80-100	50-90	20-40	6-20
	28-60	Stratified silt loam to fine sand.	SM, ML	A-2, A-4	0	100	95-100	70-100	30-80	<35	NP-10
DdA, DdB, DdC2---- Dodge	0-11	Silt loam-------	CL, CL-ML, ML	A-4	0	100	100	90-100	70-95	20-30	3-10
	11-29	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-55	15-25
	29-35	Clay loam, sandy clay loam.	CL, SC	A-6, A-7	0-2	90-100	85-95	75-95	45-60	30-45	15-25
	35-60	Gravelly loam, gravelly sandy loam, gravelly silt loam.	ML, CL, SM, SC	A-2, A-4	1-5	75-90	65-90	60-80	15-70	15-30	NP-10

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	
EbA---------- Elburn	0-24	Silt loam-------	CL	A-6	0	100	100	95-100	90-100	25-40	10-25
	24-45	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	75-90	30-50	10-35
	45-60	Loam, sandy loam, clay loam.	CL, CL-ML, SC, SM-SC	A-6, A-4, A-2	0	90-100	80-100	60-90	25-80	20-40	5-20
Ev---------- Elvers	0-32	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	32-56	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	56-60	Silt loam, loam, sand.	ML, CL, SM, SC	A-2, A-3, A-4, A-6	0	80-100	80-100	50-100	5-90	<30	NP-15
FoE2---------- Fox	0-5	Loam----------	ML, CL, CL-ML	A-4	0	95-100	85-100	75-95	55-90	20-30	3-10
	5-22	Clay loam, loam, sandy clay loam.	CL, SC	A-2, A-3, A-6	0	85-100	75-95	50-95	20-65	25-45	10-25
	22-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2, A-3	0-5	40-100	35-100	15-95	2-15	---	NP
FsA, FsB, FsC2, FsD2---------- Fox	0-12	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	12-36	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	85-100	75-100	70-95	55-90	25-45	10-25
	36-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2, A-3	0-5	40-100	35-100	15-95	2-15	---	NP
Fu*. Fluvaquents											
FxC3---------- Fox	0-6	Clay loam-------	CL	A-6	0	90-100	75-100	75-95	60-80	20-40	10-20
	6-26	Clay loam, loam, sandy clay loam.	CL, SC	A-2, A-3, A-6	0	85-100	75-95	50-95	20-65	25-45	10-25
	26-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2, A-3	0-5	40-100	35-100	15-95	2-15	---	NP
Gb---------- Granby Variant	0-8	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	40-55	<19	NP-4
	8-11	Loam----------	ML, CL, CL-ML	A-4	0	100	100	85-95	60-75	20-30	3-10
	11-30	Fine sand-------	SM	A-2	0	100	100	65-80	20-35	---	NP
	30-60	Sand----------	SP-SM	A-2, A-3	0	100	100	50-70	5-15	---	NP
HnB, HnC2, HnD2, HnE2---------- Hochheim	0-7	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	85-100	60-90	20-30	3-10
	7-16	Clay loam-------	CL, CH	A-6, A-7	0-2	85-95	70-85	60-70	55-65	35-55	15-35
	16-60	Gravelly loam, gravelly sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-10	50-95	50-90	30-80	15-75	<20	NP-6
HoD3---------- Hochheim	0-10	Clay loam-------	CL	A-6	0-2	90-100	90-100	90-100	70-80	25-40	10-21
	10-60	Gravelly loam, gravelly sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-10	50-95	50-90	30-80	15-75	<20	NP-6
Hu, Hw---------- Houghton	0-60	Sapric material	Pt	---	0	---	---	---	---	---	---

See footnote at end of table.

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	
IoA---------- Ionia	0-15	Silt loam-------	CL, ML, CL-ML	A-4, A-6	0	95-100	90-100	80-100	60-90	20-35	3-15
	15-32	Silty clay loam, clay loam.	CL	A-6	0	95-100	90-100	85-100	80-95	25-40	10-20
	32-36	Gravelly clay loam, gravelly sandy clay loam, gravelly sandy loam.	SM, SC, ML, CL	A-2, A-4	0	85-100	65-100	50-80	15-60	12-30	NP-10
	36-60	Sand and gravel	SP	A-3, A-2	0	55-80	50-70	50-70	0-4	---	NP
JuA, JuB---------- Juneau	0-6	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	6-24	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-30	3-12
	24-54	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-30
	54-60	Clay loam, silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	25-40	10-21
Ke---------- Keowns	0-16	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	85-100	60-90	20-30	3-10
	16-32	Silt loam, very fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4, A-2	0	100	100	60-100	30-85	<20	NP-10
	32-60	Stratified silt loam, fine sand, and sand.	ML, SM	A-2, A-4	0	100	100	70-95	30-95	<20	NP-4
KlA, KlB---------- Kibbie	0-14	Loam----------	ML	A-4, A-6	0	100	100	75-95	50-85	25-40	2-14
	14-35	Silt loam, silty clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-7	0	90-100	85-100	75-95	45-60	25-45	6-25
	35-60	Stratified silt loam to fine sand.	ML, SM, SC, CL	A-4, A-2	0	100	95-100	70-95	30-80	<30	NP-10
KrB, KrC2, KrD2, KrE2---------- Kidder	0-13	Loam----------	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	60-90	20-30	3-10
	13-36	Clay loam, sandy clay loam, loam.	CL, SC	A-6, A-7	0-5	75-100	75-100	65-95	45-70	25-40	8-15
	36-60	Sandy loam, gravelly sandy loam.	SM	A-2	3-10	50-90	50-90	50-80	15-35	---	NP
KwA, KwB, KwC2----- Knowles	0-12	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	85-95	20-30	3-10
	12-23	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	85-95	30-40	10-15
	23-25	Clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0-5	75-95	75-95	60-90	50-70	20-35	5-15
	25-60	Unweathered bedrock.	---	---	0	---	---	---	---	---	---
KxA, KxB---------- Knowles Variant	0-13	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	85-95	20-30	3-10
	13-27	Silty clay loam	CL	A-6	0	100	100	90-100	85-95	30-40	10-15
	27-30	Clay loam-------	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	80-90	75-85	25-35	5-15
	30-60	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	
LmA, LmB---------- Lamartine	0-11	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	11-25	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-30
	25-35	Clay loam, loam	CL	A-6	0	85-100	85-100	85-95	60-80	25-40	10-25
	35-60	Loam, sandy loam, gravelly sandy loam.	CL, ML, SM, SC	A-4, A-6	0	75-90	65-90	60-80	35-70	20-30	NP-10
LrB, LrC2, LrD2, LrE2---------- LeRoy	0-9	Silt loam-------	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	20-30	3-10
	9-19	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-35	10-20
	19-22	Clay loam, loam, sandy clay loam.	CL	A-4, A-6	0-2	85-100	80-95	70-80	50-60	25-40	8-15
	22-60	Gravelly loam, gravelly sandy loam, very gravelly sandy loam.	SM, SM-SC, GM, GM-GC	A-2, A-4	3-10	55-85	50-80	45-65	25-40	<25	NP-6
LvB, LvC2---------- Lomira	0-14	Silt loam-------	ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	14-31	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	31-34	Sandy clay loam, clay loam, loam.	CL	A-4, A-6	0-2	85-100	80-95	70-80	50-60	20-30	8-15
	34-60	Gravelly loam, gravelly sandy loam, very gravelly sandy loam.	SM, GM, GM-GC, SM-SC	A-2, A-4	3-10	55-85	50-80	45-65	25-40	<25	NP-6
MdB, MdC2---------- Markesan	0-9	Silt loam-------	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	20-30	3-10
	9-15	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-35	10-15
	15-18	Silty clay loam, loam, sandy clay loam.	CL	A-6	0-2	85-100	80-95	70-80	50-85	25-40	8-15
	18-60	Gravelly loam, gravelly sandy loam, very gravelly sandy loam.	GM, GC, SC, SM	A-2, A-4, A-1	3-10	55-85	50-80	45-65	25-40	<25	NP-10
MoA, MoB, MoC------ Mayville	0-11	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	11-25	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	80-100	70-95	35-55	15-30
	25-31	Silty clay loam, clay loam.	CL	A-6, A-7	0-2	90-100	85-95	75-95	70-85	30-45	15-25
	31-60	Gravelly sandy loam, loam, gravelly loam.	SM, SC, ML, CL	A-2, A-4	0-5	75-90	65-90	60-80	15-70	15-30	NP-10
MrB, MrC2, MrD2---- McHenry	0-12	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	70-90	20-40	5-15
	12-38	Silty clay loam, clay loam, sandy clay loam.	CL	A-7, A-6	0	95-100	90-100	80-100	55-90	35-50	25-35
	38-60	Sandy loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4	0-5	85-100	65-90	55-80	20-45	<20	NP-10

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	
MsB, MsC2---------- Mendota	0-18	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	18-29	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	29-34	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0-2	85-100	80-95	70-80	50-60	25-40	8-15
	34-60	Gravelly loam, gravelly sandy loam, very gravelly sandy loam.	SM, SM-SC, GM, GM-GC	A-2, A-4	3-10	55-85	50-80	45-65	25-40	<25	NP-6
MyB, MyC2, MyD2---- Miami	0-12	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	22-34	6-15
	12-28	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7	0	92-99	89-97	78-95	64-95	35-50	17-31
	28-60	Loam, clay loam, sandy loam.	CL, CL-ML, ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	17-30	2-14
MzD3, MzE3--------- Miami	0-8	Clay loam-------	CL	A-6, A-7	0	100	90-100	75-95	65-95	30-45	15-25
	8-16	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7	0	92-99	89-97	78-95	64-95	35-50	17-31
	16-60	Loam, clay loam, sandy loam.	CL, CL-ML, ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	17-30	2-14
NeB, NeC2, NeD2, NeE2---------- Neda	0-11	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-80	20-30	3-10
	11-16	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-50	10-30
	16-25	Clay loam, shaly clay loam, loam.	CL	A-4, A-6, A-7	5-10	75-95	75-95	70-90	60-80	30-50	10-30
	25-60	Loam, shaly loam	CL	A-4, A-6	5-10	75-95	75-95	70-90	50-60	25-35	10-15
NvB, NvC2---------- Neda Variant	0-12	Silt loam-------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-95	20-30	3-10
	12-21	Silty clay------	CH	A-7	0	100	100	95-100	90-95	50-60	30-35
	21-25	Stratified silt loam to silty clay.	CL	A-7	0	100	100	90-100	85-95	40-50	22-30
	25-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
NxA, NxB---------- Nenno	0-10	Silt loam-------	ML, CL, CL-ML	A-4	0-1	95-100	95-100	75-85	50-70	20-30	3-10
	10-21	Clay loam, loam, silty clay loam.	CL, CH	A-6, A-7	0-2	85-100	70-100	60-100	55-95	35-55	15-35
	21-60	Gravelly loam, gravelly sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-10	50-95	50-90	30-80	15-75	<20	NP-6
Ot---------- Otter	0-60	Silt loam-------	CL	A-6, A-7	0	100	98-100	90-100	80-100	30-45	10-20
Pa---------- Palms	0-26	Sapric material	Pt	---	---	---	---	---	---	---	---
	26-60	Clay loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20

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	
Ph	0-14	Silty clay loam	CL	A-6, A-7	0	100	95-100	85-100	70-95	30-50	15-30
Pella	14-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	70-95	30-50	15-30
	46-60	Gravelly loam, sandy loam, silty clay loam	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-5	90-100	80-100	50-100	30-85	20-35	7-20
Pk	0-11	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-95	20-30	1-15
Pella Variant	11-28	Silty clay loam	CL	A-6	0	100	100	95-100	90-95	30-40	20-30
	28-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Pn*.											
Pits											
PsA, PsB	0-23	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	20-30	5-15
Plano	23-58	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	95-100	25-40	10-25
	58-60	Stratified silt loam to sandy loam.	ML, SM, CL, SC	A-4, A-2	0-5	90-100	80-90	60-90	30-70	<25	NP-10
PtA	0-16	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	20-30	5-15
Plano	16-42	Silty clay loam	CL	A-6	0	100	100	95-100	95-100	25-40	10-25
	42-60	Stratified silt loam to sandy loam.	ML, SM, CL, SC	A-4, A-2	0-5	90-100	80-90	60-90	30-70	<25	NP-10
PuB	0-13	Loamy fine sand	SM	A-2, A-4	0	100	100	60-80	25-40	---	NP
Puchyan	13-27	Loamy fine sand, fine sand.	SM	A-2, A-4	0	100	100	60-80	20-40	---	NP
	27-36	Loam, sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	60-90	30-70	<20	2-6
	36-54	Silt loam	CL	A-4, A-6	0	100	100	95-100	85-95	25-40	10-20
	54-60	Gravelly loam, loam, sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	1-10	80-95	80-95	55-85	25-65	<20	NP-6
RcE*:											
Channahon	0-13	Silt loam	CL	A-6, A-4	0-20	95-100	95-100	85-100	65-90	21-38	7-18
	13-18	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
	18-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
RxC2*, RxD2*:											
Rodman	0-11	Gravelly loam	ML, CL, SM, GM	A-4	0-2	70-85	65-85	60-80	36-65	<30	3-9
	11-60	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
Casco	0-11	Loam	ML, GM-GC, SM-SC, CL	A-4	0	60-100	50-100	50-100	40-75	20-30	3-10
	11-20	Clay loam, loam, sandy clay loam.	SC, CL, GC	A-6, A-7	0-5	60-100	55-100	55-90	35-70	25-45	11-25
	20-60	Sand and gravel	GP, SP, GP-GM, SP-SM	A-1, A-3, A-2	0-10	30-100	30-90	10-90	3-10	---	NP

See footnote at end of table.

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	
ScA, ScB, ScC2----- St. Charles	0-10	Silt loam-------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	95-100	20-35	3-15
	10-42	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	90-100	25-40	10-25
	42-60	Stratified silt loam to sandy loam.	ML, SC, SM, CL	A-2, A-4	0-5	90-100	80-90	60-90	30-70	<25	3-10
SdA---------- St. Charles	0-22	Silt loam-------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	95-100	20-35	3-15
	22-51	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	90-100	25-40	10-25
	51-60	Stratified silt loam to sandy loam.	ML, SC, SM, CL	A-2, A-4	0-5	90-100	80-90	60-90	30-70	<25	3-10
SeA, SeB---------- St. Charles	0-14	Silt loam-------	CL, ML	A-4, A-6	0	100	100	90-100	80-95	29-38	7-15
	14-43	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	90-100	25-40	10-25
	43-48	Clay loam, sandy clay loam, gravelly clay loam.	CL, SC	A-6, A-7, A-2	1-5	75-90	60-85	50-80	30-60	30-45	15-22
	48-60	Stratified sand to gravelly sand.	SP, SP-SM GP-SM, GP	A-1	1-5	30-70	22-55	7-20	2-10	<30	NP
Sk*. Saprists and Aquents											
Sm---------- Sebewa	0-12	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	75-95	50-90	22-35	6-12
	12-27	Sandy clay loam, loam, clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	27-60	Sand and gravel, sand.	SP, SP-SM GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
SuA, SuB, SuC2, SuD2---------- Sisson	0-12	Fine sandy loam	CL, ML, SM, SC	A-4	0	100	100	60-85	35-55	<28	NP-10
	12-30	Loam, clay loam, silt loam.	CL	A-4, A-6	0	100	100	85-100	60-90	18-40	7-25
	30-60	Stratified silt loam to very fine sand.	CL, ML, SM, SC	A-2, A-4, A-6	0	100	95-100	65-95	25-90	<35	NP-15
ThB, ThC2, ThD2, ThE2---------- Theresa	0-11	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	11-21	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	21-39	Clay loam, loam	CL	A-6, A-7	0-2	80-100	80-100	70-95	60-90	35-50	15-30
	39-60	Loam, gravelly loam, gravelly sandy loam.	SM, SM-SC ML, CL-ML	A-2, A-4	0-10	50-95	50-90	30-80	15-75	<20	NP-6
TrD3---------- Theresa	0-8	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	8-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	15-30
	13-31	Clay loam, loam	CL	A-6, A-7	0-2	80-100	80-100	70-95	60-90	35-50	15-30
	31-60	Loam, gravelly loam, gravelly sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-10	50-95	50-90	30-80	15-75	<20	NP-6
Ud*. Udorthents											
Uf*. Udifluvents											

* 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 more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
AcA----------	0-26	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	High-----	Low------	0.37	5	6
Ackmore	26-60	0.2-0.6	0.18-0.20	5.6-7.8	High------	High-----	Low------	0.37		
Ar----------	0-16	2.0-6.0	0.35-0.45	6.6-7.8	----------	High-----	Low------	0.10	5	3
Adrian Variant	16-24	0.06-0.2	0.20-0.24	6.6-7.3	Low-------	High-----	Low------	0.10		
	24-60	0.6-2.0	0.11-0.22	7.4-8.4	Low-------	High-----	Low------	0.43		
AsA, AsB----------	0-11	0.6-2.0	0.22-0.24	6.6-7.8	Low-------	High-----	Low------	0.32	5	5
Ashippun	11-20	0.6-2.0	0.18-0.22	6.6-7.8	Moderate	High-----	Low------	0.43		
	20-26	0.2-0.6	0.15-0.19	6.6-7.8	Moderate	High-----	Low------	0.43		
	26-60	0.6-2.0	0.17-0.19	7.9-8.4	Low-------	High-----	Low------	0.43		
BsA----------	0-12	0.6-2.0	0.21-0.24	6.6-7.3	Moderate	High-----	Low------	0.28	5	6
Brookston	12-36	0.6-2.0	0.15-0.19	6.6-7.3	Moderate	High-----	Low------	0.28		
	36-60	0.2-2.0	0.05-0.19	7.4-8.4	Moderate	High-----	Low------	0.28		
CcB, CcC2, CcD2----	0-11	0.6-2.0	0.15-0.24	5.6-7.3	Low-------	Low------	Low------	0.32	3	5
Casco	11-20	0.6-2.0	0.12-0.19	5.6-7.8	Moderate	Low------	Low------	0.32		
	20-60	>20	0.02-0.04	7.4-8.4	Very low	Low------	Low------	0.10		
CdB, CdC2, CdD2----	0-13	0.6-2.0	0.20-0.24	6.1-8.4	Low-------	Low------	Low------	0.37	2	6
Channahon	13-18	0.6-2.0	0.15-0.22	6.1-8.4	Moderate	Moderate	Low------	0.37		
	18-60	---	---	---	----------	---------	---------	---		
ChB, ChC----------	0-9	6.0-20	0.10-0.15	5.6-6.5	Low-------	Low------	Low------	0.17	5	2
Chelsea	9-60	6.0-20	0.06-0.08	5.1-6.0	Low-------	Low------	Low------	0.17		
Co----------	0-16	0.2-0.6	0.21-0.23	6.1-7.8	Moderate	High-----	Low------	0.28	5	7
Colwood	16-28	0.6-2.0	0.17-0.22	6.1-8.4	Moderate	High-----	Low------	0.43		
	28-60	0.6-2.0	0.12-0.22	7.4-8.4	Low-------	High-----	Low------	0.43		
DdA, DdB, DdC2-----	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Low-------	Low------	Low------	0.37	4	5
Dodge	11-29	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	Moderate	Moderate	0.37		
	29-35	0.6-2.0	0.16-0.19	5.1-6.5	Moderate	Moderate	Moderate	0.37		
	35-60	0.6-6.0	0.07-0.20	7.9-8.4	Low-------	Low------	Low------	0.37		
EbA----------	0-24	0.6-2.0	0.22-0.24	5.6-7.8	Low-------	High-----	Moderate	0.28	5	6
Elburn	24-45	0.6-2.0	0.18-0.20	5.6-7.8	Moderate	High-----	Moderate	0.43		
	45-60	0.6-6.0	0.12-0.18	6.1-8.4	Low-------	Moderate	Low------	0.43		
Ev----------	0-32	0.6-2.0	0.20-0.22	6.1-7.8	Low-------	High-----	Low------	0.43	5	5
Elvers	32-56	2.0-6.0	0.35-0.45	6.1-7.3	----------	High-----	Moderate	0.10		
	56-60	0.6-2.0	0.05-0.22	6.1-7.3	Low-------	High-----	Low------	0.43		
FoE2----------	0-5	0.6-2.0	0.20-0.22	5.1-6.5	Low-------	Low------	Moderate	0.37	3	6
Fox	5-22	0.6-2.0	0.12-0.14	5.6-7.8	Moderate	Low------	Moderate	0.37		
	22-60	>20	0.02-0.04	7.9-8.4	Low-------	Low------	Low------	0.10		
FsA, FsB, FsC2, FsD2----------	0-12	0.6-2.0	0.20-0.22	5.1-6.5	Low-------	Low------	Moderate	0.37	3	6
Fox	12-36	0.6-2.0	0.18-0.20	5.6-7.8	Moderate	Low------	Moderate	0.37		
	36-60	>20	0.02-0.04	7.9-8.4	Low-------	Low------	Low------	0.10		
Fu*. Fluvaquents										
FxC3----------	0-6	0.6-2.0	0.17-0.19	5.1-6.5	Moderate	Low------	Moderate	0.32	3	6
Fox	6-26	0.6-2.0	0.12-0.14	5.6-7.8	Moderate	Low------	Moderate	0.37		
	26-60	>20	0.02-0.04	7.9-8.4	Low-------	Low------	Low------	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Gb	0-8	2.0-6.0	0.16-0.18	7.4-8.4	Low	High	Low	0.20	5	3
Granby Variant	8-11	0.6-2.0	0.20-0.22	7.4-8.4	Low	High	Low	0.28		
	11-30	6.0-20	0.06-0.08	7.4-8.4	Low	High	Low	0.17		
	30-60	6.0-20	0.05-0.07	7.4-8.4	Low	High	Low	0.17		
HnB, HnC2, HnD2, HnE2	0-7	0.6-2.0	0.20-0.24	6.1-7.8	Low	Low	Low	0.32	3	5
Hochheim	7-16	0.6-2.0	0.15-0.19	6.1-7.8	Moderate	Moderate	Low	0.32		
	16-60	0.2-2.0	0.08-0.17	7.9-8.4	Low	Moderate	Low	0.32		
HoD3	0-10	0.6-2.0	0.17-0.19	6.1-7.8	Moderate	Moderate	Low	0.32	2	6
Hochheim	10-60	0.2-2.0	0.08-0.17	7.9-8.4	Low	Moderate	Low	0.32		
Hu, Hw	0-60	2.0-6.0	0.35-0.45	6.6-7.8	---	High	Low	0.10	5	3
Houghton										
IoA	0-15	0.6-2.0	0.20-0.24	4.5-6.5	Low	Low	Moderate	0.32	4	5
Ionia	15-32	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	Moderate	Moderate	0.32		
	32-36	0.6-2.0	0.12-0.19	5.6-7.3	Low	Low	Low	0.32		
	36-60	>20	0.02-0.04	7.4-8.4	Low	Low	Low	0.10		
JuA, JuB	0-6	0.6-2.0	0.22-0.24	5.6-7.8	Low	Moderate	Moderate	0.37	5	5
Juneau	6-24	0.6-2.0	0.20-0.22	5.6-7.8	Low	Moderate	Moderate	0.37		
	24-54	0.6-2.0	0.18-0.22	5.6-7.8	Moderate	Moderate	Moderate	0.37		
	54-60	0.6-2.0	0.14-0.16	5.6-7.8	Moderate	High	Moderate	0.37		
Ke	0-16	0.6-2.0	0.20-0.24	6.6-8.4	Low	High	Low	0.32	5	5
Keowns	16-32	0.6-2.0	0.12-0.22	6.6-8.4	Low	High	Low	0.32		
	32-60	0.6-2.0	0.11-0.22	7.4-8.4	Low	High	Low	0.32		
KlA, KlB	0-14	0.6-2.0	0.16-0.24	5.6-7.3	Low	High	Moderate	0.28	5	5
Kibbie	14-35	0.6-2.0	0.17-0.22	5.6-7.3	Low	High	Moderate	0.43		
	35-60	0.6-2.0	0.12-0.22	7.4-8.4	Low	High	Low	0.43		
KrB, KrC2, KrD2, KrE2	0-13	0.6-2.0	0.20-0.24	6.1-7.8	Low	Moderate	Low	0.32	5	5
Kidder	13-36	0.6-2.0	0.15-0.19	5.6-7.8	Moderate	Moderate	Low	0.32		
	36-60	2.0-6.0	0.09-0.11	7.4-7.8	Low	Low	Low	0.32		
KwA, KwB, KwC2	0-12	0.6-2.0	0.22-0.24	5.6-7.3	Low	Low	Low	0.32	4	5
Knowles	12-23	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	Moderate	Moderate	0.43		
	23-25	0.6-2.0	0.16-0.19	6.1-8.4	Moderate	Moderate	Low	0.43		
	25-60	---	---	---	---	---	---	---		
KxA, KxB	0-13	0.6-2.0	0.22-0.24	7.4-7.8	Low	Low	Low	0.32	4	5
Knowles Variant	13-27	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	Moderate	Moderate	0.43		
	27-30	0.6-2.0	0.15-0.19	7.9-8.4	Moderate	Moderate	Low	0.43		
	30-60	---	---	---	---	---	---	---		
LmA, LmB	0-11	0.6-2.0	0.22-0.24	6.1-7.8	Low	High	Low	0.32	5	5
Lamartine	11-25	0.6-2.0	0.18-0.22	6.1-7.8	Moderate	High	Low	0.43		
	25-35	0.6-2.0	0.15-0.19	6.6-7.8	Moderate	High	Low	0.43		
	35-60	0.6-6.0	0.17-0.19	7.4-8.4	Low	High	Low	0.32		
LrB, LrC2, LrD2, LrE2	0-9	0.6-2.0	0.22-0.24	5.6-7.3	Low	Low	Low	0.37	4	5
LeRoy	9-19	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	Low	Moderate	0.37		
	19-22	0.6-2.0	0.13-0.19	6.6-8.4	Moderate	Moderate	Low	0.37		
	22-60	0.6-2.0	0.08-0.15	7.9-8.4	Low	Moderate	Low	0.28		
LvB, LvC2	0-14	0.6-2.0	0.22-0.24	5.6-7.3	Low	Low	Low	0.37	4	5
Lomira	14-31	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	Low	Moderate	0.37		
	31-34	0.6-2.0	0.13-0.19	6.6-8.4	Moderate	Moderate	Low	0.37		
	34-60	0.6-2.0	0.08-0.15	7.9-8.4	Low	Moderate	Low	0.28		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
MdB, MdC2----------	0-9	0.6-2.0	0.22-0.24	5.6-7.3	Low-------	Low------	Low------	0.32	3	5
Markesan	9-15	0.6-2.0	0.18-0.20	5.6-6.5	Moderate	Low------	Low------	0.43		
	15-18	0.6-2.0	0.16-0.20	6.6-8.4	Moderate	Moderate	Low------	0.43		
	18-60	0.6-2.0	0.10-0.15	7.9-8.4	Low-------	Moderate	Low------	0.28		
MoA, MoB, MoC------	0-11	0.6-2.0	0.22-0.24	5.6-7.3	Low-------	Moderate	Low------	0.37	4	5
Mayville	11-25	0.6-2.0	0.18-0.24	5.1-6.5	Moderate	Moderate	Moderate	0.37		
	25-31	0.6-2.0	0.15-0.20	5.1-6.5	Moderate	Moderate	Moderate	0.37		
	31-60	0.6-2.0	0.07-0.20	7.9-8.4	Low-------	Moderate	Low------	0.28		
MrB, MrC2, MrD2----	0-12	0.6-2.0	0.22-0.24	5.6-7.3	Low-------	Low------	Moderate	0.37	5	5
McHenry	12-38	0.6-2.0	0.15-0.20	5.1-7.8	Moderate	High-----	Moderate	0.37		
	38-60	0.6-6.0	0.05-0.07	7.4-8.4	Low-------	Low------	Low------	0.28		
MsB, MsC2----------	0-18	0.6-2.0	0.20-0.22	5.6-7.3	Low-------	Low------	Low------	0.32	4	5
Mendota	18-29	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	Low------	Moderate	0.32		
	29-34	0.6-2.0	0.13-0.19	6.6-8.4	Moderate	Moderate	Low------	0.32		
	34-60	0.6-2.0	0.08-0.15	7.9-8.4	Low-------	Moderate	Low------	0.32		
MyB, MyC2, MyD2----	0-12	0.6-2.0	0.20-0.24	5.6-7.3	Low-------	Low------	Moderate	0.37	5	5
Miami	12-28	0.6-2.0	0.15-0.20	5.6-7.3	Moderate	Moderate	Moderate	0.37		
	28-60	0.2-2.0	0.05-0.19	6.6-8.4	Low-------	Low------	Low------	0.37		
MzD3, MzE3---------	0-8	0.6-2.0	0.17-0.19	5.6-7.3	Moderate	Moderate	Moderate	0.37	4	6
Miami	8-16	0.6-2.0	0.15-0.20	5.6-7.3	Moderate	Moderate	Moderate	0.37		
	16-60	0.2-2.0	0.05-0.19	6.6-8.4	Low-------	Low------	Low------	0.37		
NeB, NeC2, NeD2, NeE2----------	0-11	0.6-2.0	0.22-0.24	6.6-7.8	Low-------	Moderate	Low------	0.32	4	5
Neda	11-16	0.6-2.0	0.18-0.22	6.6-7.8	Moderate	Moderate	Low------	0.32		
	16-25	0.2-0.6	0.15-0.19	6.6-7.8	Moderate	Moderate	Low------	0.32		
	25-60	0.6-2.0	0.17-0.19	7.9-8.4	Low-------	Moderate	Low------	0.32		
NvB, NvC2----------	0-12	0.6-2.0	0.22-0.24	7.4-8.4	Low-------	Moderate	Low------	0.43	3	5
Neda variant	12-21	0.06-0.2	0.11-0.13	7.4-8.4	High------	Moderate	Low------	0.32		
	21-25	0.06-0.2	0.11-0.22	7.4-8.4	Moderate	Moderate	Low------	0.32		
	25-60	---	---	---	----------	---------	---------	---		
NxA, NxB----------	0-10	0.6-2.0	0.20-0.24	6.6-7.8	Low-------	High-----	Low------	0.32	4	5
Nenno	10-21	0.6-2.0	0.15-0.20	6.6-7.8	Moderate	High-----	Low------	0.32		
	21-60	0.2-2.0	0.08-0.17	7.9-8.4	Low-------	High-----	Low------	0.32		
Ot-----------------	0-60	0.6-2.0	0.22-0.24	6.1-7.8	Low-------	High-----	Low------	0.28	5	6
Otter										
Pa-----------------	0-26	2.0-6.0	0.35-0.45	6.6-8.4	----------	High-----	Moderate	0.10	5	3
Palms	26-60	0.2-2.0	0.14-0.22	6.6-8.4	Low-------	High-----	Low------	0.10		
Ph-----------------	0-14	0.6-2.0	0.21-0.23	6.1-7.8	Moderate	High-----	Moderate	0.28	5	7
Pella	14-46	0.6-2.0	0.21-0.24	7.4-8.4	Moderate	High-----	Low------	0.28		
	46-60	0.6-2.0	0.10-0.22	7.4-8.4	Low-------	High-----	Low------	0.28		
Pk-----------------	0-11	0.6-2.0	0.22-0.24	7.4-7.8	Low-------	High-----	Low------	0.28	4	5
Pella Variant	11-28	0.2-0.6	0.18-0.20	7.9-8.4	Moderate	High-----	Low------	0.28		
	28-60	---	---	---	----------	---------	---------	---		
Pn*. Pits										
PsA, PsB-----------	0-23	0.6-2.0	0.22-0.24	6.1-7.3	Low-------	Low------	Low------	0.32	5	6
Plano	23-58	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	Moderate	Low------	0.43		
	58-60	0.6-2.0	0.11-0.22	6.6-8.4	Low-------	Low------	Low------	0.43		
PtA----------------	0-16	0.6-2.0	0.22-0.24	6.1-7.3	Low-------	Low------	Low------	0.32	5	6
Plano	16-42	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	Moderate	Low------	0.43		
	42-60	0.6-2.0	0.11-0.22	6.6-8.4	Low-------	Low------	Low------	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
PuB	0-13	2.0-6.0	0.10-0.12	5.1-6.5	Low	Low	High	0.17	5	2
Puchyan	13-27	2.0-6.0	0.06-0.11	5.1-6.5	Low	Low	High	0.17		
	27-36	0.6-6.0	0.12-0.19	5.6-6.5	Low	Low	Moderate	0.28		
	36-54	0.6-2.0	0.20-0.22	6.1-7.3	Low	Low	Low	0.28		
	54-60	0.6-2.0	0.11-0.19	7.4-8.4	Low	Low	Low	0.28		
RcE*:										
Channahon	0-13	0.6-2.0	0.20-0.24	6.1-8.4	Low	Low	Low	0.37	2	6
	13-18	0.6-2.0	0.15-0.22	6.1-8.4	Moderate	Moderate	Low	0.37		
	18-60	---	---	---	---	---	---	---		
Rock outcrop.										
RxC2*, RxD2*:										
Rodman	0-11	2.0-6.0	0.10-0.12	6.6-7.8	Low	Low	Low	0.20	3	8
	11-60	>20	0.02-0.04	7.4-8.4	Low	Low	Low	0.10		
Casco	0-11	0.6-2.0	0.15-0.24	5.6-7.3	Low	Low	Low	0.32	3	5
	11-20	0.6-2.0	0.12-0.19	5.6-7.8	Moderate	Low	Low	0.32		
	20-60	>20	0.02-0.04	7.4-8.4	Very low	Low	Low	0.10		
ScA, ScB, ScC2	0-10	0.6-2.0	0.22-0.24	5.1-6.5	Low	Moderate	Moderate	0.37	5	6
St. Charles	10-42	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	Moderate	Moderate	0.37		
	42-60	0.6-2.0	0.11-0.22	5.6-7.8	Low	Low	Low	0.37		
SdA	0-22	0.6-2.0	0.22-0.24	5.1-6.5	Low	Moderate	Moderate	0.37	5	6
St. Charles	22-51	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	Moderate	Moderate	0.37		
	51-60	0.6-2.0	0.11-0.22	5.6-7.8	Low	Low	Low	0.37		
SeA, SeB	0-14	0.6-2.0	0.22-0.24	5.6-6.0	Low	Low	Moderate	0.37	5	5
St. Charles	14-43	0.6-2.0	0.18-0.20	5.6-6.0	Moderate	Moderate	Moderate	0.37		
	43-48	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	Moderate	Moderate	0.37		
	48-60	>20	0.02-0.04	7.4-8.4	Low	Low	Low	0.10		
Sk*.										
Saprists and Aquents										
Sm	0-12	0.6-2.0	0.18-0.22	6.1-7.8	Low	High	Low	0.24	5	5
Sebewa	12-27	0.6-2.0	0.15-0.19	6.1-7.8	Moderate	High	Low	0.32		
	27-60	6.0-20	0.02-0.04	7.4-8.4	Low	High	Low	0.10		
SuA, SuB, SuC2, SuD2	0-12	0.6-2.0	0.13-0.18	6.1-7.3	Low	Low	Low	0.24	5	3
Sisson	12-30	0.6-2.0	0.15-0.22	6.1-7.8	Low	Low	Low	0.43		
	30-60	0.6-2.0	0.05-0.22	6.6-8.4	Low	Low	Low	0.43		
ThB, ThC2, ThD2, ThE2	0-11	0.6-2.0	0.22-0.24	6.1-7.8	Low	Low	Low	0.32	4	5
Theresa	11-21	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	Moderate	Low	0.43		
	21-39	0.6-2.0	0.15-0.19	6.6-8.4	Moderate	Moderate	Low	0.43		
	39-60	0.2-2.0	0.08-0.17	7.9-8.4	Low	Moderate	Low	0.43		
TrD3	0-8	0.6-2.0	0.21-0.23	6.1-7.8	Low	Low	Low	0.32	4	5
Theresa	8-13	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	Moderate	Low	0.43		
	13-31	0.6-2.0	0.15-0.19	6.6-8.4	Moderate	Moderate	Low	0.43		
	31-60	0.2-2.0	0.08-0.17	7.9-8.4	Low	Moderate	Low	0.43		
Ud*.										
Udorthents										
Uf*.										
Udifluvents										

* 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 such terms as "rare," "brief," "apparent," and "perched." The symbol > 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		Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Total	
					Ft			In		In	
AcA---------- Ackmore	B	Common------	Very brief	Sep-Jun	1.0-3.0	Apparent	Nov-Jun	>60	---	---	High.
Ar---------- Adrian Variant	A/D	Frequent----	Very long	Mar-May	0-1.0	Apparent	Jan-Dec	>60	---	35-45	High.
AsA, AsB---------- Ashippun	C	Rare--------	---	---	1.0-3.0	Perched	Apr-Jun	>60	---	---	High.
BsA---------- Brookston	B/D	Frequent----	Brief-----	Dec-May	0-1.0	Apparent	Dec-May	>60	---	---	High.
CcB, CcC2, CcD2--- Casco	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
CdB, CdC2, CdD2--- Channahon	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	Moderate.
ChB, ChC---------- Chelsea	A	None--------	---	---	>6.0	---	---	>60	---	---	Low.
Co---------- Colwood	B/D	Frequent----	Brief-----	Mar-Apr	0-1.5	Apparent	Oct-May	>60	---	---	High.
DdA, DdB, DdC2---- Dodge	B	None--------	---	---	>6.0	---	---	>60	---	---	High.
EbA---------- Elburn	B	None--------	---	---	1.0-3.0	Apparent	Jan-May	>60	---	---	High.
Ev---------- Elvers	B/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Nov-May	>60	---	---	High.
FoE2, FsA, FsB, FsC2, FsD2, FxC3 Fox	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
Fu*. Fluvaquents											
Gb---------- Granby Variant	A/D	Frequent----	Brief-----	Mar-Apr	0-1.0	Apparent	Nov-Jun	>60	---	---	Moderate.
HnB, HnC2, HnD2, HnE2, HoD3------- Hochheim	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
Hu, Hw---------- Houghton	A/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Sep-Jun	>60	---	55-60	High.
IoA---------- Ionia	B	None--------	---	---	2.0-3.0	Apparent	Nov-Apr	>60	---	---	Moderate.

JuA, JuB---------- Juneau	B	Occasional	Brief-----	Nov-May	>3.0	Apparent	Nov-May	>60	---	---	High.
Ke---------- Keowns	B/D	Frequent----	Brief-----	Mar-Apr	0-1.0	Apparent	Oct-May	>60	---	---	High.
KlA, KlB---------- Kibbie	B	Rare--------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	---	High.
KrB, KrC2, KrD2, KrE2---------- Kidder	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
KwA, KwB, KwC2---- Knowles	B	None--------	---	---	>6.0	---	---	20-40	Hard	---	High.
KxA, KxB---------- Knowles Variant	B	Occasional	Brief-----	Apr-May	1.0-3.0	Apparent	Dec-May	20-40	Hard	---	High.
LmA, LmB---------- Lamartine	C	Occasional	Very brief	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	---	High.
LrB, LrC2, LrD2, LrE2---------- Leroy	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
LvB, LvC2--------- Lomira	B	None--------	---	---	>6.0	---	---	>60	---	---	High.
MdB, MdC2--------- Markesan	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
MoA, MoB, MoC----- Mayville	B	None--------	---	---	3.0-5.0	Apparent	Nov-Apr	>60	---	---	High.
MrB, MrC2, MrD2--- McHenry	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
MsB, MsC2--------- Mendota	B	None--------	---	---	>6.0	---	---	>60	---	---	High.
MyB, MyC2, MyD2, MzD3, MzE3------- Miami	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
NeB, NeC2, NeD2, NeE2---------- Neda	C	None--------	---	---	>3.0	Perched	Apr-Jun	>60	---	---	Moderate.
NvB, NvC2--------- Neda Variant	B	None--------	---	---	3.0-5.0	Perched	Nov-May	20-40	Rip-pable	---	High.
NxA, NxB---------- Nenno	B	Occasional	Brief-----	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	---	High.
Ot---------- Otter	B/D	Frequent----	Brief-----	Apr-Jun	0-2.0	Apparent	Apr-Jun	>60	---	---	High.
Pa---------- Palms	A/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Nov-May	>60	---	25-32	High.
Ph---------- Pella	B/D	Occasional	Brief-----	Mar-Jun	0-2.0	Apparent	Mar-Jun	>60	---	---	High.

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		Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Total	
					Ft			In		In	
Pk---------- Pella Variant	D	Occasional	Brief-----	Dec-May	0-1.0	Perched	Dec-May	20-40	Hard	---	High.
Pn*. Pits											
PsA, PsB---------- Plano	B	None--------	---	---	>6.0	---	---	>60	---	---	High.
PtA Plano----------	B	None--------	---	---	3.0-5.0	Apparent	Feb-Jun	>60	---	---	High
PuB---------- Puchyan	A	None--------	---	---	>3.0	Apparent	Apr-Jun	>60	---	---	Low.
RcE*: Channahon--------	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	Moderate.
Rock outcrop.											
RxC2*, RxD2*: Rodman----------	A	None--------	---	---	>6.0	---	---	>60	---	---	Low.
Casco----------	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
ScA, ScB, ScC2---- St. Charles	B	None--------	---	---	>6.0	---	---	>60	---	---	High
SdA---------- St. Charles	B	None--------	---	---	3.0-5.0	Apparent	Feb-Jun	>60	---	---	High.
SeA, SeB---------- St. Charles	B	None--------	---	---	>6.0	---	---	>60	---	---	High.
Sk*. Saprists and Aquents											
Sm---------- Sebewa	B/D	Frequent----	Brief-----	Mar-May	0-1.0	Apparent	Sep-May	>60	---	---	High.
SuA, SuB, SuC2, SuD2---------- Sisson	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
ThB, ThC2, ThD2, ThE2, TrD3------- Theresa	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate.
Ud*. Udorthents											
Uf*. Udifluvents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ackmore	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Adrian Variant	Coprogenous, euic, mesic Limnic Medisaprists
Ashippun	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Brookston	Fine-loamy, mixed, mesic Typic Argiaquolls
Casco	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Channahon	Loamy, mixed, mesic Lithic Argiudolls
Chelsea	Mixed, mesic Alfic Udipsamments
Colwood	Fine-loamy, mixed, mesic Typic Haplaquolls
Dodge	Fine-silty, mixed, mesic Typic Hapludalfs
Elburn	Fine-silty, mixed, mesic Aquic Argiudolls
Elvers	Coarse-silty, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Fluvaquents	Loamy, mixed, nonacid, mesic Fluvaquents
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Granby Variant	Sandy, mixed (calcareous), mesic Typic Haplaquolls
Hochheim	Fine-loamy, mixed, mesic Typic Argiudolls
Houghton	Euic, mesic Typic Medisaprists
Ionia	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Juneau	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Keowns	Coarse-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Kibbie	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Kidder	Fine-loamy, mixed, mesic Typic Hapludalfs
Knowles	Fine-silty, mixed, mesic Typic Hapludalfs
Knowles Variant	Fine-silty, mixed, mesic Aquollic Hapludalfs
Lamartine	Fine-silty, mixed, mesic Aquollic Hapludalfs
LeRoy	Fine-loamy, mixed, mesic Typic Hapludalfs
Lomira	Fine-silty, mixed, mesic Typic Hapludalfs
Markesan	Fine-loamy, mixed, mesic Typic Argiudolls
Mayville	Fine-silty, mixed, mesic Typic Hapludalfs
McHenry	Fine-loamy, mixed, mesic Typic Hapludalfs
Mendota	Fine-silty, mixed, mesic Typic Argiudolls
Miami	Fine-loamy, mixed, mesic Typic Hapludalfs
Neda	Fine-loamy, mixed, mesic Mollic Hapludalfs
Neda Variant	Fine, mixed, mesic Typic Hapludalfs
Nenno	Fine-loamy, mixed, mesic Aquic Argiudolls
Otter	Fine-silty, mixed, mesic Cumulic Haplaquolls
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pella	Fine-silty, mixed, mesic Typic Haplaquolls
Pella Variant	Fine silty, mixed, mesic Typic Haplaquolls
Plano	Fine-silty, mixed, mesic Typic Argiudolls
Puchyan	Loamy, mixed, mesic Arenic Hapludalfs
Rodman	Sandy-skeletal, mixed, mesic Typic Hapludolls
Saprists and Aquents	Euic, mesic Medisaprists and loamy, mixed, nonacid, mesic Aquents
St. Charles	Fine-silty, mixed, mesic Typic Hapludalfs
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Sisson	Fine-loamy, mixed, mesic Typic Hapludalfs
Theresa	Fine-loamy, mixed, mesic Typic Hapludalfs
Udorthents	Loamy, mixed, nonacid, mesic Typic Udorthents
Udifluvents	Loamy, mixed, nonacid, mesic Udifluvents

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