United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin

# Soil Survey of Marathon County, Wisconsin

## Parts I and II

# Note to User

This PDF document represents an electronic version of the original hard-copy publication issued in 2003. The content of this version is the same as that of the hard-copy publication, but the formatting has been changed.

# How to Use This Soil Survey

### General Soil Map

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

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

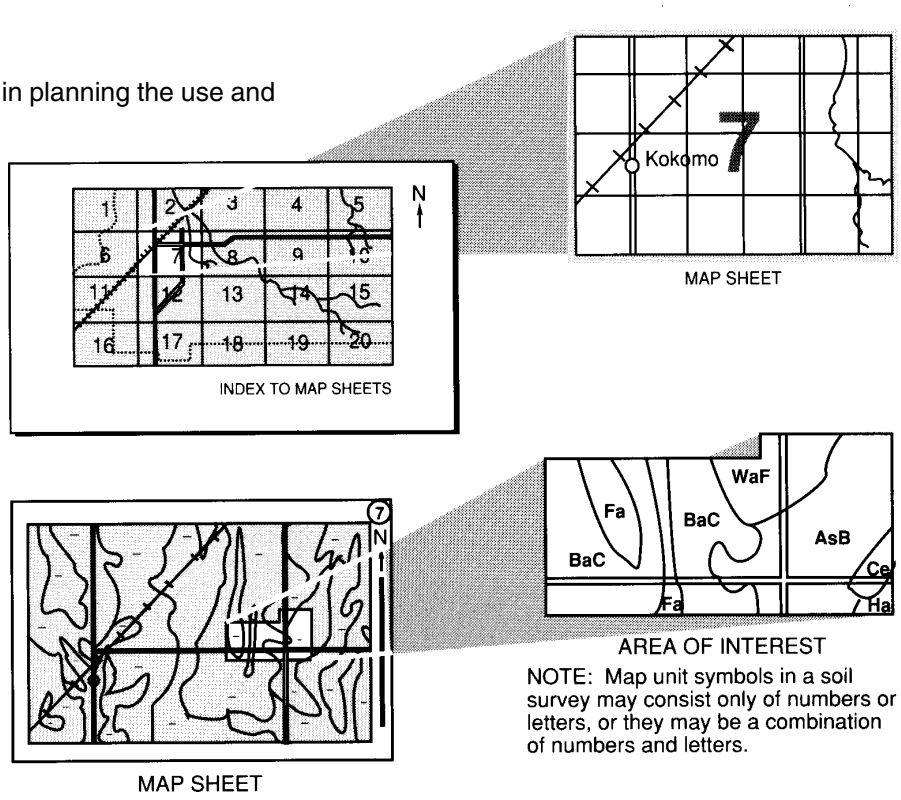
### Detailed Soil Maps

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

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

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

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




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

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

Major fieldwork for this soil survey was completed in 1985. Revised mapping of certain map units in the northern and western parts of the county was completed in 1996. Soil names and descriptions were approved in 1986 and 1997. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Natural Resources Conservation Service and the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin. It is part of the technical assistance furnished to the Marathon County Land Conservation Committee, which helped to finance the fieldwork.

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

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**Cover: A view of Lake Wausau at the junction of the Wisconsin River and the Big Rib River. Rib Mountain, a quartzite monadnock, is in the background. (Photo courtesy of the Marathon County Land Conservation Department)**

*Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").*

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# Foreword

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

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

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

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

Patricia S. Leavenworth
State Conservationist
Natural Resources Conservation Service

# Soil Survey of
# Marathon County, Wisconsin

By William D. Fiala, David A. Buss, Sam D. Hagedorn, Kim A. Kidney, and John O. Werlein, Natural Resources Conservation Service

Fieldwork by Robert J. Bartelme, David A. Buss, William D. Fiala, Sam D. Hagedorn, Richard M. Johannes, Kim A. Kidney, and John O. Werlein, Natural Resources Conservation Service; Dean M. Kaatz, Marathon County Land Conservation Department; and Gary W. Starzinski, North-Central Wisconsin Regional Planning Commission

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

Marathon County is in the central part of Wisconsin (fig. 1). It lies almost entirely within the drainage basin of the Wisconsin River. The county has a total area of 1,008,768 acres. Of this total, 985,184 acres is land and 23,584 acres is water areas greater than 40 acres. The city of Wausau is the largest community in the county and is the county seat. It has a population of 32,426.

Dairy farming is the main agricultural enterprise in the county. Ginseng farming is an important enterprise.

Older soil surveys that included Marathon County were published in 1917 *(6)* and 1921 *(16)*. The present survey updates the earlier ones and provides additional information and larger maps that show the soils in greater detail.

Mapping revised during the period from 1994 to 1996 (fig. 2) concentrated on the existing Freeon, Magnor, Marshfield, and Withee map units. As a result of the revisions, the Magnor, Marshfield, and Withee map units were redefined, a new Freeon map unit was added, and the Loyal series and its two accompanying map units were added. All of these soils formed in silty deposits and in the underlying glacial till.

## General Nature of the County

This section describes history and development; climate; physiography, relief, and drainage; water supply; and transportation facilities and industry in the county.

### History and Development

Vast white pine forests attracted the first settlers to this survey area. In 1839 George Stevens built a sawmill on the Wisconsin River at Big Bull Falls, a site that is now within the city of Wausau *(10)*. By 1849 a number of sawmills and the village of Big Bull Falls were built along the river to accommodate the large number of logs being floated down the river by lumbermen. With the extension of railroads into the county, more sawmills were built in other parts of the county as well.

As the white pine forests became depleted, the lumbering industry began to diversify. The hardwood trees that remained were used in various wood product industries. Firms to service these new industries were founded.

The county, named after a Greek battlefield, was officially established in 1850. The first group of farmers in Marathon County, German immigrants, settled in the towns of Maine and Berlin around 1855. Later, workers from the large industrialized cities and more immigrants from Europe settled throughout the county. Attempts were made to raise a variety of crops and livestock. Finally, grass and clover were found to grow

**Figure 1.—Location of Marathon County in Wisconsin.**

well on the soils that the early lumbermen had said were not suitable for agriculture. Dairy farming soon followed, with an early preference for butter production. By about 1920 most of the milk was going into the production of cheese.

Today Marathon County is a leading agricultural area and an important manufacturing center in Wisconsin.

## Climate

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

In Marathon County, winters are very cold and summers are short and fairly warm. The short freeze-free period during the summer limits cropping mainly to corn, small grain, forage crops, and adapted vegetables. Precipitation is fairly well distributed throughout the year, reaching a slight peak in summer. Snow covers the ground much of the time from late fall through early spring.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Wausau in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 15 degrees F and the average daily minimum temperature is 6 degrees. The lowest temperature on record, which occurred at Wausau on January 30, 1951, is -40 degrees. In summer, the average temperature is 67 degrees and the average daily maximum temperature is 78 degrees. The highest recorded temperature, which occurred at Wausau on July 26, 1964, is 99 degrees.

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

The total annual precipitation is about 32 inches. Of this, about 23 inches, or about 70 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 4.46 inches on June 5, 1955. Thunderstorms occur on about 38 days each year.

The average seasonal snowfall is about 51 inches. The greatest snow depth at any one time during the period of record was 34 inches. On the average, 38 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

**Figure 2.—Location of revised mapping in Marathon County.**

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 12 miles per hour, in spring.

## Physiography, Relief, and Drainage

Within Marathon County there are four major areas with distinct physiographic characteristics. These characteristics are primarily the result of glaciation and the influence of the underlying bedrock.

The far northern and western parts of the county are broad, nearly level to sloping ground moraines. The central part, except for the Wisconsin River Valley, is a mixed area of ground moraines and uplands underlain by bedrock at a depth of 2 to 20 feet. This area is nearly level to steep. The steeper areas generally are adjacent to major drainageways. The Wisconsin River Valley is composed of nearly level to very steep outwash terraces and nearly level and gently sloping flood plains. The southeastern part of the county consists mainly of nearly level to steep outwash plains and stream terraces and undulating to very hilly moraines and drumlins.

The relief of Marathon County is largely controlled by the glacial features and the bedrock. The highest elevation in the county, on top of Rib Mountain, a quartzite monadnock, is 1,941 feet. The lowest elevation, at the point where the Wisconsin River flows out of the county, is about 1,100 feet. Most of the county ranges in elevation from 1,200 to 1,450 feet. Local elevation differences are generally less than 100 feet. The greatest local elevation difference, about 750 feet, is between the top of Rib Mountain and a nearby outwash terrace in the Wisconsin River Valley.

Most of the county is within the Wisconsin River drainage basin *(4)*. The western part of the county is drained mainly by the Little Rib, Big Rib, Black, Big Eau Pleine, and Little Eau Pleine Rivers and their tributaries.

The Trappe, Big Sandy, Eau Claire, Bull Junior, Little Eau Claire, and Plover Rivers and their tributaries drain the eastern part of Marathon County. The southeastern part of the county is within the Wolf River drainage basin. The main streams in this area are Norrie Brook, Spranger Creek, Comet Creek, and the Little Wolf River.

## Water Supply

Most of Marathon County is underlain by Precambrian crystalline rock. In a few places, particularly in the southeastern and extreme southwestern parts of the county, Cambrian sandstone overlies the crystalline rock. Both of these rock formations are covered with glacial drift that ranges from 0 to 400 feet in thickness.

Ground water is pumped from aquifers in the Precambrian and Cambrian rock formations and the glacial drift *(3)*. This water meets most of the domestic, livestock, and irrigation needs in Marathon County.

Depth to the water table generally ranges from 0 to 20 feet in the outwash and glacial lake deposits and from 50 to 100 feet in areas of pitted outwash; it is as much as 170 feet in the end moraines. Depth to water in the area of ground moraines ranges from 20 to 50 feet *(5)*.

The highest well yields are from wells in areas underlain by thick, permeable deposits of saturated sand and gravel. Yields of 500 to 1,000 gallons per minute are common from those sand and gravel areas that are adjacent to the Wisconsin River in the area between the Lincoln County line and the city of Mosinee and also in the extreme northeastern part of the county. Yields of 50 to 500 gallons per minute can be expected from outwash areas adjacent to the Trappe, Rib, and Eau Claire Rivers, along the lower reaches of the Wisconsin River, and in the eastern part of the county. Yields of less than 50 gallons per minute can be expected in other areas of the county, most of which are covered by ground moraines. Generally, the lowest yields occur where the ground moraines are underlain by bedrock at a shallow depth. Local geologic conditions may result in differences in these well yields.

Ground water quality is generally good throughout Marathon County. Some local problems include excessive iron, nitrate, and total dissolved solids.

Ground water movement in the Wisconsin and Fox-Wolf River basins is generally from the sides of the basin that face toward these rivers and their tributaries.

Marathon County has 23,584 acres of surface water of more than 40 acres. Additional surface water is in smaller rivers, streams, lakes, and ponds. The surface water is used for industry, power generation, irrigation, recreation, sewage disposal, and livestock watering. The quality of surface water is affected by variables, such as dissolved minerals, temperature, dissolved oxygen, and the biochemical oxygen demand.

## Transportation Facilities and Industry

Marathon County is served by Central Wisconsin Airport at Mosinee and by the Wausau Municipal

Airport. Two intercity bus lines furnish passenger transportation to all principal Wisconsin cities. Charter service also is available. Three railways provide freight service. All parts of the county can be reached by good hard-surfaced or gravel roads. State Highways 13, 97, and 107 and U.S. Highway 51 are the main north-south roads in the county. State Highways 29 and 153 are the main east-west roads.

Agriculture is the main industry in Marathon County. Dairying is the predominant type of farming. Marathon County ranks first in Wisconsin in total number of cows, total milk production, and receipts by farmers for sales of dairy products *(17)*. Other enterprises include farm equipment sales and service; feed, seed, and fertilizer supplies; and livestock marketing. Marathon County ranks first in the United States in the production of ginseng, a high-value specialty crop.

About 37 percent of Marathon County is woodland. The lumber and paper product industries are leading employers in the county.

Mineral production in the county presently includes sand and gravel, granite for roadfill, crushed stone for roofing granules, and granite for memorials.

The tourist and recreation industries are also important in Marathon County. Fishing, swimming, hunting, snowmobiling, and cross-country and downhill skiing are activities that attract many outdoor enthusiasts.

## How This Survey Was Made

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

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

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

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

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

Predictions about soil behavior are based not only on soil properties but also on such variables as

climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

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

## Map Unit Composition

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

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

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

## Survey Procedures

The general procedures followed in making this survey are described in the *National Soil Survey Handbook* of the Natural Resources Conservation Service. The *Reconnaissance Soil Survey of South Part of North-Central Wisconsin (6)*, published in 1917, and the *Soil Survey of Northern Wisconsin (16)*, published in 1921, are two of the references used.

Before daily fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs. Work prior to 1979 was completed on aerial photographs made in 1968 at a scale of 1:15,840. Work completed after 1979 was on aerial photographs made in 1978 at a scale of 1:20,000. U.S. Geological Survey 7.5- and 15-minute topographic maps and the aerial photographs were studied to relate land and image features before traverses of the landscape were made.

Traverses were made at intervals of about one-fifth of a mile in the parts of Marathon County where land is used predominantly for crops and such nonagricultural purposes as building sites and septic tank absorption fields. Traverses were made at closer intervals in areas where the soil pattern is highly variable. In areas where present and anticipated land use is related to forestry, the traverse intervals were increased.

Soil examinations along the traverses were made 100 to 400 yards apart, depending upon the landscape, soil pattern, and experience of the mapper. Observations of such features as landforms, vegetation, and road cuts were made continuously without regard to spacing. Soil boundaries were drawn on the basis of soil examinations, observations, and aerial photo interpretation. The soil material was examined with the aid of a hand auger to a depth of 5 feet or to bedrock, where bedrock was at a depth of less than 5 feet.

Samples for analysis were taken of most of the

major soils in the survey area. The analyses were made by the National Soil Survey Laboratory, Lincoln, Nebraska, and the Wisconsin Department of Transportation, Division of Highways and Transportation Facilities, Madison, Wisconsin. The results of the Wisconsin Department of Transportation analyses are given in table 18 of this survey. The other results can be obtained by request from the State Office of the Natural Resources Conservation Service in Madison, Wisconsin.

After completion of the soil mapping on aerial photographs at scales of 1:15,840 and 1:20,000, the photographs were converted to clear film positives at a scale of 1:20,000. The map unit delineations were transferred to halftone positives at a scale of 1:20,000. Surface drainage was mapped in the field. Some place names and cultural features were transferred from U.S. Geological Survey topographic maps. Others were recorded from visual observations.

# General Soil Map Units

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

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

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

The general soil map of Marathon County joins the general soil maps of Langlade, Portage, Shawano, Waupaca, and Wood Counties. The soil surveys of these counties were published at earlier dates. The associations in these surveys do not fully agree with those in Marathon County. Some differences are the result of improvement in the classification of soils, particularly in the modification or refinement of soil series concepts. More precise and detailed maps were needed because the use of the general soil maps has expanded in recent years; the more modern maps meet this need. Other differences result from variations in the extent of the major soils in the different surveys.

## Areas Dominated by Soils Underlain by Loamy Glacial Till

This group of associations makes up about 31 percent of the county. The soils are nearly level and gently sloping. They formed in silty and loamy deposits underlain by loamy glacial till. They are moderately well drained to very poorly drained.

Most areas are used as cropland. Undrained wet soils are used as woodland, pasture, or wildlife habitat. The soils in this group are poorly suited or generally unsuited to dwellings and septic tank absorption fields.

### 1. Magnor-Freeon-Cable Association

*Deep, nearly level to sloping, moderately well drained to very poorly drained, stony and silty soils on ground moraines*

This association consists of soils on ground moraines dissected by small streams and intermittent drainageways. It makes up about 10 percent of the county. It is about 35 percent Magnor soils, 35 percent Freeon soils, 15 percent Cable soils, and 15 percent soils of minor extent.

Magnor soils are nearly level and gently sloping and are somewhat poorly drained. They are in concave areas on broad plains. Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The next layer is about 14 inches thick. It is mottled. It is pale brown and strong brown silt loam in the upper part and yellowish red and pinkish gray sandy loam in the lower part. The subsoil is yellowish red and reddish brown, mottled sandy loam about 26 inches thick. The substratum to a depth of about 60 inches is dark reddish brown gravelly sandy loam.

Freeon soils are gently sloping and sloping and are moderately well drained. They are on tops and sides of broad knolls and ridges. Typically, the surface layer is dark brown silt loam about 9 inches thick. The next layer is about 12 inches thick. It is brown and dark yellowish brown silt loam in the upper part and dark yellowish brown and brown, mottled silt loam in the lower part. The subsoil is reddish brown, mottled loam, gravelly loam, and gravelly sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown gravelly sandy loam.

Cable soils are nearly level and gently sloping and are poorly drained and very poorly drained. They are in depressions and drainageways. Most areas have cobbles and stones on the surface. Typically, the surface layer is very dark brown silt loam about 3 inches thick. The subsurface layer is dark gray, mottled silt loam about 4 inches thick. The subsoil is about 20 inches thick. It is grayish brown and mottled. It is silt

loam in the upper part and loam in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled gravelly sandy loam.

Some of the minor soils in this association are the Amery, Fenwood, and Rietbrock soils. The well drained Amery soils are on the tops and sides of knolls and ridges. The well drained Fenwood soils and the somewhat poorly drained Rietbrock soils are on the tops and sides of hills and ridges and are adjacent to major drainageways. They are underlain by bedrock.

Many areas of the Freeon and Magnor soils are used as cropland. Water erosion is the main hazard in areas of the Freeon soils. Wetness is the main limitation in areas of the Magnor soils. Most areas of the Cable soils are used as woodland. Wetness and stoniness are the main limitations in areas of the Cable soils used for cultivated crops. The Freeon and Magnor soils are suited to cultivated crops and trees. The Cable soils are suited to trees.

The Freeon and Magnor soils are poorly suited to septic tank absorption fields because of wetness and very slow permeability. The Freeon soils are poorly suited to dwellings with basements because of wetness. They are only moderately suited to dwellings without basements because of wetness and the slope. The Magnor soils are poorly suited to dwellings because of wetness. The Cable soils are generally unsuited to these uses because of ponding and moderately slow permeability.

## 2. Loyal-Withee-Marshfield Association

*Deep, nearly level to sloping, moderately well drained to poorly drained, silty soils on ground moraines*

This association consists of soils on ground moraines dissected by small streams and intermittent drainageways. It makes up about 21 percent of the county. It is about 40 percent Loyal soils, 40 percent Withee soils, 10 percent Marshfield soils, and 10 percent soils of minor extent.

Loyal soils are nearly level to sloping and are moderately well drained. They are on tops and sides of broad knolls and ridges. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown, mottled silt loam about 11 inches thick. The subsoil is mottled loam about 29 inches thick. It is reddish brown and brown in the upper part and dark reddish brown in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled loam.

Withee soils are nearly level and gently sloping and are somewhat poorly drained. They are in concave areas on broad plains. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 5 inches thick. The next layer is about 19 inches thick. It is mottled. It is brown and dark brown silt loam in the upper part and dark brown loam and brown silt loam in the lower part. The subsoil is about 13 inches thick. It is reddish brown and mottled. It is clay loam in the upper part and sandy clay loam in the lower part. The substratum to a depth of about 60 inches is reddish brown sandy clay loam.

Marshfield soils are nearly level and gently sloping and are poorly drained. They are in depressions and drainageways. Typically, the surface layer is very dark brown, mottled silt loam about 8 inches thick. The subsurface layer is grayish brown, mottled silt loam about 8 inches thick. The subsoil is light brownish gray, mottled silt loam and loam about 18 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled sandy loam.

Some of the minor soils in this association are the Cathro, Fenwood, Freeon, Rietbrock, and Rozellville soils. The very poorly drained Cathro soils are in drainageways and depressions. The well drained Fenwood and Rozellville soils and the somewhat poorly drained Rietbrock soils are on the tops and sides of knolls and hills and are underlain by igneous and metamorphic bedrock. The moderately well drained Freeon soils are on the tops and sides of knolls and ridges.

Many areas of the Loyal and Withee soils and drained areas of the Marshfield soils are used as cropland. Most of the undrained areas of Marshfield soils are used as woodland or unimproved pasture. Water erosion is the main hazard in areas of the Loyal soils. Wetness is the main limitation in areas of Withee and Marshfield soils. In areas of the Marshfield soils, frost is a hazard late in spring and early in fall. The Loyal and Withee soils and, where adequately drained, the Marshfield soils are generally suited to cultivated crops. All of the major soils are suited to trees.

The Loyal and Withee soils are poorly suited to septic tank absorption fields because of wetness and very slow permeability. The Loyal soils are poorly suited to dwellings with basements because of wetness. They are only moderately suited to dwellings without basements because of wetness and the slope. The Withee soils are poorly suited to dwellings because of wetness. The Marshfield soils are generally unsuited to these uses because of ponding and moderately slow permeability.

## Areas Dominated by Soils Underlain by Sandy or Loamy Glacial Till, Residuum, or Bedrock

This group of associations makes up about 51 percent of the county. The soils are nearly level to steep. They formed in silty, loamy, or sandy deposits underlain by sandy or loamy glacial till, residuum, or bedrock. They are somewhat excessively drained, well drained, somewhat poorly drained, and poorly drained.

Most of the less sloping areas are used as cropland. The wetter and more sloping soils and the stony and bouldery soils are used as woodland or pasture.

Most of the well drained and somewhat excessively drained soils with slopes of less than 6 percent are suited to dwellings. These soils are suited or only moderately suited to septic tank absorption fields. The wetter soils are poorly suited or are generally unsuited to dwellings and septic tank absorption fields.

### 3. Kennan-Hatley Association

*Deep, nearly level to steep, well drained and somewhat poorly drained, bouldery, cobbly, silty, and loamy soils on moraines and drumlins*

This association consists of soils on ground, terminal, and recessional moraines and on drumlins. It makes up about 9 percent of the county. It is about 55 percent Kennan soils, 10 percent Hatley soils, and 35 percent soils of minor extent (fig. 3).

Kennan soils are gently sloping to steep and are well drained. They are on the tops and sides of knolls, hills, and ridges on terminal and recessional moraines and on drumlins. Most uncultivated areas have stones and boulders on the surface. Typically, the surface layer is dark brown sandy loam about 8 inches thick. The next layer is brown and dark brown sandy loam about 18 inches thick. The subsoil is dark brown sandy loam about 22 inches thick. The substratum to a depth of about 60 inches is brown loamy sand.

Hatley soils are nearly level and undulating and are somewhat poorly drained. They are in slight depressions and are adjacent to drainageways and bogs on ground, terminal, and recessional moraines. Most uncultivated areas have stones and boulders on the surface. Typically, the surface layer is very dark grayish brown cobbly silt loam about 5 inches thick. Below that is dark brown cobbly silt loam about 3 inches thick. The next layer is about 12 inches thick. It is brown and dark brown, mottled cobbly silt loam in the upper part and dark brown and brown, mottled loam in the lower part. The subsoil is dark brown, mottled loam about 12 inches thick. The next layer is dark brown, mottled sandy loam about 12 inches thick. The substratum to a depth of about 60 inches is brown, mottled loamy sand.

Some of the minor soils in this association are the Alban, Chetek, Graycalm, Greenwood, Oesterle, Plover, Rosholt, Scott Lake, and Seelyeville soils. The moderately well drained Alban soils, the somewhat excessively drained and moderately well drained Graycalm soils, and the somewhat poorly drained Plover soils are on glacial lake plains and stream terraces. The somewhat excessively drained Chetek soils, the well drained Rosholt soils, the moderately well drained Scott Lake soils, and the somewhat poorly drained Oesterle soils are on outwash plains and stream terraces. The very poorly drained Greenwood and Seelyeville soils are in bogs in depressions.

Most of the less sloping and nonbouldery areas of this association are used as cropland. The steeper and bouldery areas are used as woodland or unimproved pasture. Water erosion, slope, and stones and boulders on the surface are the main management concerns in areas used for cultivated crops. The wetness of the Hatley soils also is a limitation. The less sloping and nonbouldery areas are suited to cultivated crops and to trees.

The gently sloping areas of the Kennan soils, where the stones and boulders have been removed, are suited to septic tank absorption fields and to dwellings. The sloping and bouldery areas of the Kennan soils are only moderately suited to these uses. The more sloping, bouldery and nonbouldery areas are poorly suited because of slope. The Hatley soils are poorly suited to septic tank absorption fields and to dwellings because of wetness.

### 4. Marathon-Mylrea-Moberg Association

*Deep, nearly level to moderately steep, well drained, somewhat poorly drained, and somewhat excessively drained, stony, gravelly, and silty soils on uplands and ground moraines*

This association consists of soils on uplands and ground moraines. It makes up about 7 percent of the county. It is about 30 percent Marathon soils, 30 percent Mylrea soils, 10 percent Moberg soils, and 30 percent soils of minor extent.

Marathon soils are gently sloping to moderately steep and are well drained. They are on the tops and sides of broad knolls and ridges on uplands. Some

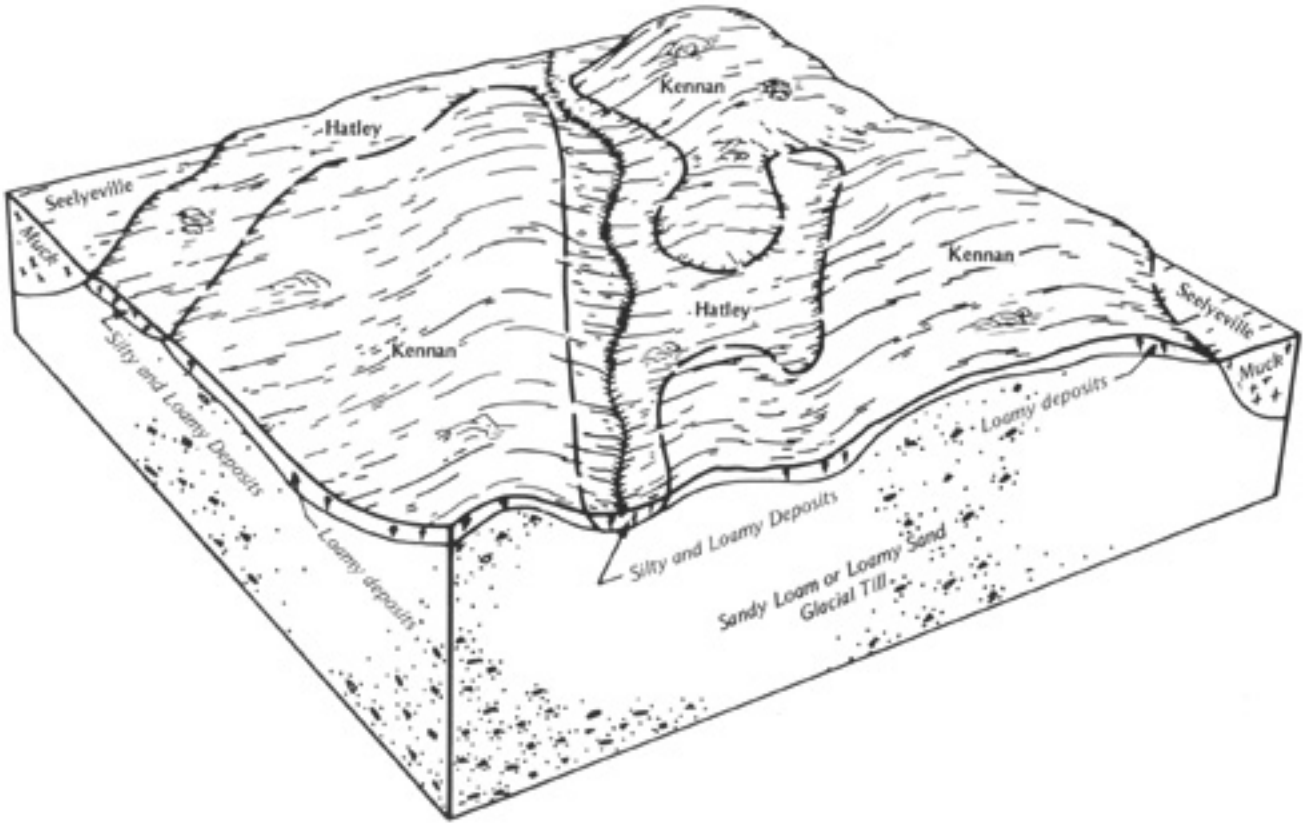


**Figure 3.—Pattern of soils and parent material in the Kennan-Hatley association.**

uncultivated areas have cobbles, stones, and boulders on the surface. Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is brown, dark yellowish brown, and dark brown silt loam about 19 inches thick. The subsoil is about 28 inches thick. It is brown and dark brown very gravelly coarse sandy loam in the upper part and dark brown, strong brown, and yellowish red extremely gravelly loamy coarse sand in the lower part. The substratum to a depth of about 60 inches is strong brown extremely gravelly loamy coarse sand.

Mylrea soils are nearly level and gently sloping and are somewhat poorly drained. They are in small areas on convex and concave plains and are on concave foot slopes on ground moraines. Many uncultivated areas have cobbles, stones, and boulders on the surface. Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark yellowish brown silt loam about 6 inches thick. The subsurface layer is light grayish brown, mottled silt loam about 3 inches thick. Below this is dark yellowish brown and pale brown, mottled silt loam about 7 inches thick. The subsoil is about 14 inches thick. It is mottled. It is yellowish brown silt loam in the upper part and dark brown fine sandy loam in the lower part. The next layer is dark brown, mottled gravelly fine sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is brown, mottled extremely gravelly loamy coarse sand.

Moberg soils are gently sloping to moderately steep and are somewhat excessively drained. They are on the tops and sides of knolls and ridges on uplands. Typically, the surface layer is very dark grayish brown gravelly silt loam about 4 inches thick. The subsoil is dark brown gravelly silt loam about 8 inches thick. The next layer is strong brown very gravelly coarse sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is strong brown extremely gravelly loamy coarse sand.

Some of the minor soils in this association are the Fenwood, Mosinee, Rietbrock, Rozellville, and Sherry soils. The well drained Fenwood, Mosinee, and Rozellville soils are on knolls, ridgetops, and hillsides

in the uplands. The somewhat poorly drained Rietbrock soils are on the concave or convex tops of broad knolls, along drainageways, and at the base of slopes in the uplands. The poorly drained and very poorly drained Sherry soils are in drainageways and depressions.

Many of the nonstony areas of the Marathon soils, some areas of the Moberg soils, and some of the nonstony areas of the Mylrea soils are used as cropland. Many areas of the Moberg and Mylrea soils are used as woodland. Water erosion is the main hazard if cultivated crops are grown. Also, the Moberg soils are droughty, some areas of the Marathon and Mylrea soils are stony, and the Mylrea soils that have a slope of less than 2 percent are excessively wet. In the nonstony areas, this association is generally suited to cultivated crops. It is suited to trees.

The nonstony, gently sloping areas of the Marathon and Moberg soils are suited to dwellings. The gently sloping Marathon soils are suited to septic tank absorption fields. The more sloping areas of the Marathon soils are only moderately suited to septic tank absorption fields and to dwellings because of slope. The Moberg soils can readily absorb the effluent in the septic tank absorption fields, but they cannot adequately filter it. The poor filtering capacity can result in the pollution of ground water. The Mylrea soils are poorly suited to these uses because of wetness and rapid or very rapid permeability.

## 5. Fenwood-Rietbrock-Rozellville Association

*Deep, nearly level to steep, well drained and somewhat poorly drained, stony and silty soils on ground moraines and bedrock-controlled uplands*

This association consists of soils on ground moraines and on uplands underlain by igneous and metamorphic bedrock. It makes up about 23 percent of the county. It is about 30 percent Fenwood soils, 30 percent Rietbrock soils, 15 percent Rozellville soils, and 25 percent soils of minor extent (fig. 4).

Fenwood soils are gently sloping to steep and are well drained. They are on the tops and sides of knolls, hills, and ridges on uplands underlain by bedrock. Some uncultivated areas have cobbles, stones, and bedrock outcrops on the surface. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is grayish brown and brown loam about 4 inches thick. The next layer is brown, dark yellowish brown, and dark brown loam about 12 inches thick. The subsoil is about 19 inches thick. It is dark brown. It is gravelly loam in the upper part and cobbly loam in the lower part. Fractured igneous and metamorphic bedrock is at a depth of about 43 inches.

Rietbrock soils are nearly level to sloping and are somewhat poorly drained. They are on the concave or convex tops of broad knolls, at the base of slopes, and along the edges of drainageways on ground moraines and on uplands underlain by bedrock. Many uncultivated areas have cobbles, stones, and bedrock outcrops on the surface. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 3 inches thick. The next 11 inches is brown, mottled silt loam and dark brown, mottled loam. The subsoil is about 23 inches thick. It is dark brown and mottled. It is gravelly loam in the upper part, gravelly clay loam in the next part, and cobbly loam in the lower part. Shattered igneous and metamorphic bedrock is at a depth of about 45 inches.

Rozellville soils are gently sloping and well drained. They are mapped in complex with the Fenwood soils on the tops of knolls and hills on uplands. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next layer is brown and dark brown silt loam about 7 inches thick. The subsoil is about 21 inches thick. It is dark brown clay loam in the upper part and yellowish brown sandy loam in the lower part. The substratum to a depth of about 60 inches is olive brown gravelly loam.

Some of the minor soils in this association are the Loyal, Marathon, Meadland, Mylrea, Ribhill, and Sherry soils. The moderately well drained Loyal soils, the well drained Marathon soils, and the somewhat poorly drained Mylrea soils are on broad knolls, ridgetops, and side slopes in the uplands. The somewhat poorly drained Meadland soils are in broad, slightly convex and concave areas on plains on ground moraines. The well drained Ribhill soils are on the tops and sides of hills and ridges on quartzite monadnocks. The poorly drained and very poorly drained Sherry soils are in depressions and drainageways.

Many of the less sloping and nonstony areas in this association are used as cropland. The more sloping or stony areas are used as woodland. Erosion is the main hazard in most areas used as cropland, and in some areas stoniness is the main limitation. The Rietbrock soils also are limited by wetness on slopes of less than 2 percent. Most of this association is suited to cultivated crops and to trees.

The less sloping areas of the Fenwood soils are only moderately suited to septic tank absorption fields and to dwellings with basements because of the

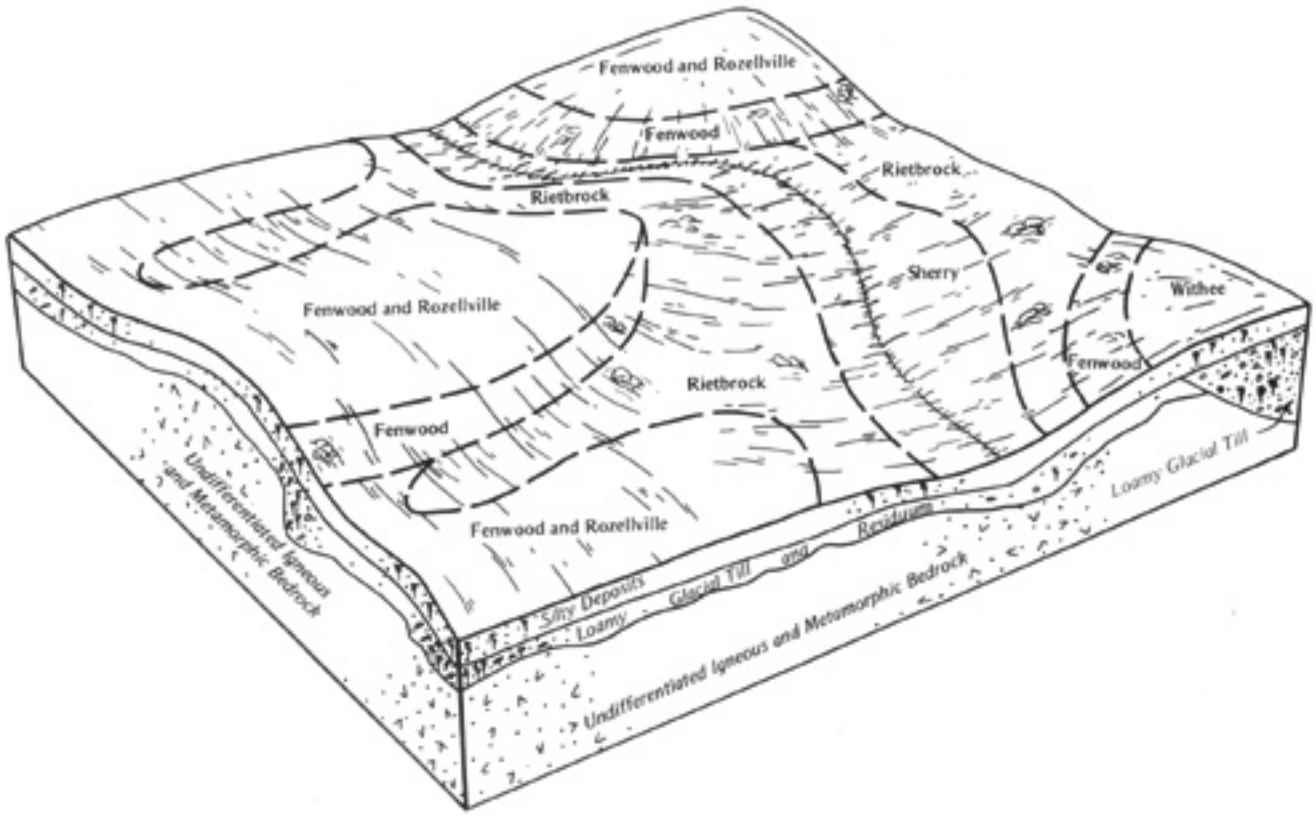


**Figure 4.—Pattern of soils and parent material in the Fenwood-Rietbrock-Rozellville association.**

shallow depth over bedrock. The more sloping areas of the Fenwood soils are poorly suited to these uses because of the slope. The Rozellville soils are only moderately suited to septic tank absorption fields because of moderate permeability. They are suited to dwellings. The Rietbrock soils are poorly suited to septic tank absorption fields and to dwellings because of the wetness.

## 6. Meadland-Mosinee-Dancy Association

*Deep, nearly level to moderately steep, somewhat poorly drained, well drained, and poorly drained, stony and loamy soils on ground moraines and bedrock-controlled uplands*

This association consists of soils on ground moraines and on uplands underlain by igneous and metamorphic bedrock. It makes up about 12 percent of the county. It is about 40 percent Meadland soils, 25 percent Mosinee soils, 10 percent Dancy soils, and 25 percent soils of minor extent.

Meadland soils are nearly level and gently sloping and are somewhat poorly drained. They are on slightly convex and concave, broad ground moraines. Many uncultivated areas have cobbles, stones, and bedrock outcrops on the surface. Typically, the surface layer is very dark brown loam about 2 inches thick. The next layer is dark brown loam about 5 inches thick. Below this is brown and dark yellowish brown, mottled loam about 18 inches thick. The subsoil is dark yellowish brown, mottled loam about 16 inches thick. The substratum to a depth of about 60 inches is multicolored gravelly loam.

Mosinee soils are gently sloping to moderately steep and are well drained. They are on the tops and sides of knolls, hills, and ridges on uplands underlain by bedrock. Many uncultivated areas have cobbles, stones, and bedrock outcrops on the surface. Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 35 inches thick. It is dark yellowish brown gravelly sandy loam in the upper part, yellowish brown gravelly and very gravelly sandy loam in the next part, and yellowish brown extremely gravelly sandy loam in the lower part. Fractured

igneous and metamorphic bedrock is at a depth of about 42 inches.

Dancy soils are nearly level and are poorly drained. They are in drainageways and depressions on ground moraines. Typically, the surface layer is black sandy loam about 4 inches thick. The subsurface layer is gray, mottled loamy sand about 6 inches thick. The next layer is gray and brown, mottled loamy sand and sandy loam about 11 inches thick. The subsoil is light grayish brown, mottled loam about 9 inches thick. Below this is dark grayish brown, mottled loam about 11 inches thick. The substratum to a depth of about 60 inches is multicolored sandy loam.

Some of the minor soils in this association are the Fenwood, Guenther, Mahtomedi, Meehan, Rietbrock, and Rockers soils. The well drained Fenwood soils and the somewhat poorly drained Rietbrock soils are on the tops and sides of knolls and ridges. The moderately well drained Guenther soils and the somewhat poorly drained Rockers soils are on knolls and in convex and concave areas on uplands. The excessively drained and moderately well drained Mahtomedi soils and the somewhat poorly drained Meehan soils are on stream terraces and outwash plains.

Many areas of the soils in this association are used as woodland. Some of the less sloping and nonstony areas of the Mosinee soils, some of the nonstony areas of the Meadland soils, and a few drained areas of the Dancy soils are used as cropland. The stony and more sloping areas of the Mosinee soils, the stony areas of the Meadland soils, and the undrained areas of the Dancy soils are used as woodland. Erosion is the main hazard on the Mosinee soils. The Meadland soils are limited by wetness and stoniness. The main management concerns on the Dancy soils are ponding and wetness. The less sloping and nonstony areas of the Mosinee soils and the nonstony areas of the Meadland soils are suited to cultivated crops. This association is suited to trees.

The gently sloping areas of the Mosinee soils are only moderately suited to septic tank absorption fields and to dwellings because of the shallow depth over bedrock. The sloping and stony areas of the Mosinee soils are only moderately suited to septic tank absorption fields and to dwellings because of slope, stones, and the shallow depth over bedrock. The more sloping areas of this association are poorly suited to these uses because of slope. The Meadland soils are poorly suited to these uses because of wetness and moderately slow permeability. The Dancy soils are generally unsuited to septic tank absorption fields and to dwellings because of ponding.

## Areas Dominated by Soils Underlain by Silty, Loamy, or Sandy, Alluvial, Lacustrine, or Outwash Deposits

This group of associations makes up about 15 percent of the county. The soils are nearly level to very steep. They formed in, and are underlain by, silty, loamy, or sandy deposits. They are excessively drained to very poorly drained.

Many of the less sloping areas of the better drained soils are used as cropland. The wetter and more sloping soils are used as woodland.

The well drained, somewhat excessively drained, and excessively drained soils that have slopes of less than 6 percent are suited to dwellings. These soils can readily absorb the effluent in septic tank absorption fields but cannot adequately filter it. The poor filtering capacity can result in the pollution of ground water. The moderately well drained soils are suited to dwellings without basements and are poorly suited to dwellings with basements. They are poorly suited to septic tank absorption fields. The wetter soils are poorly suited or generally unsuited to dwellings and septic tank absorption fields.

### 7. Mahtomedi-Fordum-Sturgeon Association

*Deep, nearly level to very steep, excessively drained, moderately well drained, poorly drained, very poorly drained, and somewhat poorly drained, sandy and silty soils on stream terraces, outwash plains, and flood plains*

This association consists of soils on outwash plains and stream terraces dissected by flood plains along the major streams and rivers. It makes up about 8 percent of the county. It is about 35 percent Mahtomedi soils, 25 percent Fordum soils, 10 percent Sturgeon soils, and 30 percent soils of minor extent.

Mahtomedi soils are nearly level to very steep and are excessively drained and moderately well drained. They are on broad or narrow flats, on the tops and sides of knolls, and on escarpments on stream terraces and outwash plains. Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsoil is about 16 inches thick. It is dark brown. It is loamy sand in the upper part and gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is light brown gravelly coarse sand. In places the substratum is mottled.

Fordum soils are nearly level and are poorly drained and very poorly drained. They are in depressions, drainageways, and overflow channels; in low areas on flood plains; and on islands in large rivers. Typically, the surface layer is very dark brown silt loam about 6 inches thick. The upper part of the substratum is dark gray, mottled silt loam and fine sandy loam. The lower part to a depth of about 60 inches is gray sand.

Sturgeon soils are nearly level and somewhat poorly drained. They are in convex areas on flood plains and on islands in large rivers. Many areas are dissected by overflow channels. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper part of the substratum is dark yellowish brown silt loam about 10 inches thick. The next part is about 13 inches of dark brown, mottled, stratified silt loam, sandy loam, and loam and about 10 inches of dark yellowish brown, mottled sand. The lower part to a depth of about 60 inches is brown sand.

Some of the minor soils in this association are the Chetek, Dunnville, Meehan, Minocqua, Newson, and Oesterle soils. The somewhat excessively drained Chetek soils, the somewhat poorly drained Meehan and Oesterle soils, and the poorly drained and very poorly drained Minocqua and Newson soils are on outwash plains and stream terraces. The moderately well drained Dunnville soils are on low stream terraces.

Many of the less sloping areas of the Mahtomedi soils are used as cropland. Some of these areas have been planted to pine trees. Many areas of the Fordum and Sturgeon soils are used as woodland. Droughtiness and soil blowing are the main management concerns in cultivated areas of the Mahtomedi soils. The main management concerns on the Fordum and Sturgeon soils are flooding, ponding, and wetness. Where adequately protected from soil blowing, the less sloping areas of the Mahtomedi soils are suited to cultivated crops. Where drained and protected from flooding, the Sturgeon soils also are suited to cultivated crops. The Fordum soils are poorly suited to cultivated crops because of ponding and flooding. This association is suited to trees.

The gently sloping areas of the excessively drained Mahtomedi soils are suited to dwellings. The sloping areas are only moderately suited to dwellings because of the slope, and the steeper areas are poorly suited. The nearly level to moderately steep Mahtomedi soils can readily absorb the effluent in septic tank absorption fields but cannot adequately filter it. The poor filtering capacity can result in pollution of the ground water. The steep and very steep Mahtomedi soils are generally unsuited to septic tank absorption fields because of slope and a poor filtering capacity. The moderately well drained areas of the Mahtomedi soils are poorly suited to septic tank absorption fields because of wetness and a poor filtering capacity. They are only moderately suited to dwellings with basements because of wetness. The Fordum and Sturgeon soils are generally unsuited to these uses because of wetness and flooding.

## 8. Chetek-Rosholt-Oesterle Association

*Deep, nearly level to steep, somewhat excessively drained, well drained, and somewhat poorly drained, loamy and silty soils on outwash plains and stream terraces*

This association consists of soils on outwash plains and stream terraces. It makes up about 5 percent of the county. It is about 25 percent Chetek soils, 25 percent Rosholt soils, 15 percent Oesterle soils, and 35 percent soils of minor extent (fig. 5).

Chetek soils are nearly level to steep and are somewhat excessively drained. They are on broad or narrow, convex or concave flats; on the tops and sides of knolls, hills, and ridges; and on escarpments. Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 5 inches thick. The subsoil is about 10 inches thick. It is dark brown sandy loam in the upper part and brown gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand.

Rosholt soils are nearly level and gently sloping and are well drained. They are in convex and concave areas and on flats. Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The next layer is brown and dark brown sandy loam about 7 inches thick. The subsoil is about 13 inches thick. It is dark brown. It is gravelly sandy loam in the upper part and very gravelly loamy coarse sand in the lower part. The substratum to a depth of about 60 inches is brown and reddish yellow very gravelly sand.

Oesterle soils are nearly level and are somewhat poorly drained. They are on narrow flats adjacent to depressions and drainageways. Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The next layer is brown, dark yellowish brown, and dark brown, mottled sandy loam about 7 inches thick. The subsoil is about 16 inches thick. It is mottled. It is dark brown sandy loam in the upper part and light yellowish brown loamy sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown, mottled sand.

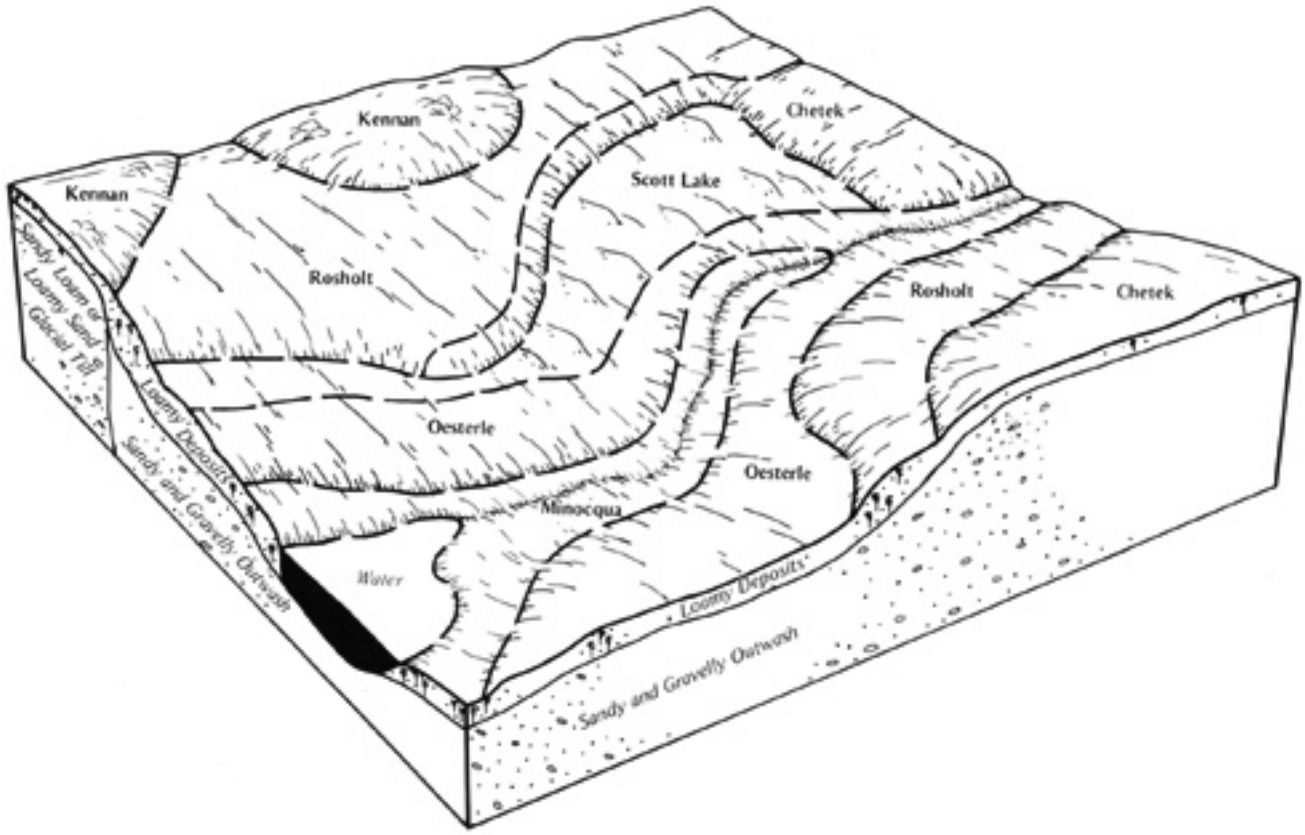


**Figure 5.—Pattern of soils and parent material in the Chetek-Rosholt-Oesterle association.**

Some of the minor soils in this association are the Alban, Graycalm, Hatley, Kennan, Mahtomedi, Minocqua, Plover, and Scott Lake soils. The moderately well drained Alban soils, the somewhat excessively drained and moderately well drained Graycalm soils, the excessively drained and moderately well drained Mahtomedi soils, and the somewhat poorly drained Plover soils are on flats and on the tops of knolls and hills on glacial lake plains and stream terraces. The somewhat poorly drained Hatley soils and the well drained Kennan soils are on the tops and sides of knolls, hills, and ridges and in depressions on ground, terminal, and recessional moraines and on drumlins. The poorly drained and very poorly drained Minocqua soils are in depressions and drainageways. The moderately well drained Scott Lake soils are on broad flats adjacent to lower depressional areas.

Many areas in this association are used as cropland. Many of the moderately steep and steep areas of the Chetek soils and undrained areas of the Oesterle soils are used as woodland. Erosion, drought, and soil blowing are the main hazards in cultivated areas. A high water table also is a limitation in the Oesterle soils. Most of the less sloping areas in this association are suited to cultivated crops. The moderately steep and steep areas of the Chetek soils are poorly suited to cultivated crops because of a severe hazard of water erosion. This association is suited to trees.

The nearly level and gently sloping areas of the Chetek soils and the Rosholt soils are suited to dwellings. The sloping areas are only moderately suited and the steeper areas are poorly suited to dwellings because of the slope. All three soils in this association can readily absorb the effluent in septic tank absorption fields but cannot adequately filter it. The poor filtering capacity can result in the pollution of ground water. The moderately steep and steep areas of the Chetek soils are poorly suited to septic tank absorption fields because of both slope and the poor filtering capacity. The Oesterle soils are poorly suited to dwellings and septic tank absorption fields because of wetness and the poor filtering capacity.

## 9. Mahtomedi-Graycalm-Meehan Association

*Deep, nearly level to very steep, excessively drained, somewhat excessively drained, moderately well drained, and somewhat poorly drained, sandy soils on outwash plains, stream terraces, and glacial lake plains*

This association consists of soils on outwash plains, on stream terraces, and in glacial lake basins. It makes up about 2 percent of the county. It is about 40 percent Mahtomedi soils, 15 percent Graycalm soils, 15 percent Meehan soils, and 30 percent soils of minor extent.

Mahtomedi soils are nearly level to very steep and are excessively drained and moderately well drained. They are on broad or narrow flats; on the sides and tops of knolls, hills, and ridges; and on escarpments on stream terraces and outwash plains. Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsoil is about 16 inches thick. It is dark brown. It is loamy sand in the upper part and gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is light brown gravelly coarse sand. In places the substratum is mottled.

Graycalm soils are nearly level and gently sloping and are somewhat excessively drained and moderately well drained. They are on small, convex or concave flats or knolls on outwash plains and glacial lake plains. Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is dark brown and strong brown loamy sand about 17 inches thick. Between depths of 26 and 52 inches is yellowish brown loamy sand with lamellae of brown fine sandy loam. The substratum to a depth of about 60 inches is brownish yellow sand. In many places the lamellae and substratum are mottled.

Meehan soils are nearly level and are somewhat poorly drained. They are on flats around depressions and along drainageways on outwash plains, stream terraces, and glacial lake plains. Typically, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsoil is loamy sand about 12 inches thick. It is dark brown in the upper part and strong brown and mottled in the lower part. The next layer is strong brown, mottled sand about 8 inches thick. The substratum to a depth of about 60 inches is grayish brown, mottled sand.

Some of the minor soils in this association are the Cathro, Hatley, Kennan, Newson, and Seelyeville soils. The very poorly drained Cathro and Seelyeville soils and the poorly drained and very poorly drained Newson soils are in bogs, depressions, and drainageways. The somewhat poorly drained Hatley soils and the well drained Kennan soils are on the tops and sides of knolls, hills, and ridges and in depressions on recessional and ground moraines and on drumlins.

Many areas in this association are used as cropland. Many undrained areas of the Meehan soils and the moderately steep to very steep areas of the Mahtomedi soils are used as woodland. Drought and soil blowing are the main hazards in cultivated areas. A high water table also is a limitation in the Meehan soils. Where irrigated and adequately protected from soil blowing, the less sloping areas in this association are suited to cultivated crops, including vegetables, such as potatoes. Controlled drainage is needed to lower the water table in the Meehan soils. This association is suited to trees.

The somewhat excessively drained areas of the Graycalm soils and the gently sloping areas of the excessively drained Mahtomedi soils are suited to dwellings. The sloping areas of the Mahtomedi soils are only moderately suited to dwellings because of the slope, and the steeper areas are poorly suited. All three soils in this association can readily absorb the effluent in septic tank absorption fields but cannot adequately filter it. The poor filtering capacity can result in the pollution of ground water. The Meehan soils and the moderately well drained areas of the Graycalm and Mahtomedi soils are poorly suited to septic tank absorption fields because of wetness and the poor filtering capacity. They are only moderately suited to dwellings with basements because of wetness.

## Areas Dominated by Organic Soils That Are Mucky Throughout or Are Mucky in the Upper Part and Are Underlain by Silty or Loamy Deposits

These soils make up about 3 percent of the county. They are nearly level. They formed in organic deposits or organic deposits underlain by silty or loamy deposits. They are very poorly drained.

Most areas are used as wildlife habitat or woodland. The soils are generally unsuited to dwellings and septic tank absorption fields.

## 10. Cathro-Seelyeville Association

*Deep, nearly level, very poorly drained, mucky soils in depressions on ground moraines, outwash plains, and glacial lake plains*

This association consists of soils in bogs, depressions, and drainageways on glacial moraines, outwash plains, and glacial lake plains. It makes up about 3 percent of the county. It is about 40 percent Cathro soils, 30 percent Seelyeville soils, and 30 percent soils of minor extent.

Cathro soils are nearly level and are very poorly drained. They are in depressions and drainageways. Typically, the organic layer is muck about 28 inches thick. It is dark reddish brown in the upper part and black and dark reddish brown in the lower part. The upper part of the substratum is dark gray silt loam about 5 inches thick. The lower part to a depth of about 60 inches is gray, mottled loam.

Seelyeville soils are nearly level and are very poorly drained. They are in bogs, depressions, and drainageways. Typically, they are black muck to a depth of at least 60 inches.

Some of the minor soils in this association are the Fordum, Marshfield, Minocqua, Newson, and Sturgeon soils. The poorly drained and very poorly drained Fordum soils and the somewhat poorly drained Sturgeon soils are on flood plains. The poorly drained Marshfield soils and the poorly drained and very poorly drained Minocqua and Newson soils are in drainageways and depressions.

Some areas of this association are used as woodland. Other areas are used for wildlife habitat. This association is limited by ponding. It generally is unsuited to cultivated crops because of the wetness and a hazard of frost late in spring and early in fall. It is suited to trees.

This association generally is unsuited to septic tank absorption fields and to dwellings because of ponding and subsidence.

# Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Fenwood silt loam, 6 to 12 percent slopes, is a phase of the Fenwood series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Fenwood-Rozellville silt loams, 2 to 6 percent slopes, is an example.

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

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

The detailed soil maps do not fully agree with those for adjacent counties published at an earlier date. Some differences are the result of improvement in the classification of soils, particularly in the modification or refinement of soil series concepts. Other differences result from variations in the extent of the major soils, the texture of the surface layer, or the range in slopes that was permitted within the map units in different surveys.

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

### AbB—Alban loam, 1 to 6 percent slopes

This deep, nearly level and gently sloping, moderately well drained soil is in small, convex areas on flats or knolls. It is on glacial lake plains, delta kames, and stream terraces. Most areas are circular or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 4 inches thick. The next layer is about 23 inches thick. It is brown loam and dark brown fine sandy loam in the upper part and dark brown fine sandy loam and brown sandy loam in the lower part. The subsoil is dark brown, mottled fine sandy loam about 4 inches thick. The substratum to a depth of about 60 inches is brown, mottled fine sand that has

strata of dark brown loamy fine sand. In places the upper part of the soil is sandy loam or silt loam.

Included with this soil in mapping are small areas of the Plover, Graycalm, Rosholt, and Scott Lake soils. The somewhat poorly drained Plover soils are in the slightly lower landscape positions. The somewhat excessively drained and moderately well drained Graycalm soils, the well drained Rosholt soils, and the moderately well drained Scott Lake soils are in landscape positions similar to those of the Alban soil. Graycalm soils have more sand and less silt and clay in the upper part than does the Alban soil. Rosholt and Scott Lake soils have a sand or a gravelly or very gravelly sand substratum. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in this Alban soil. Surface runoff is slow or medium. Available water capacity is high. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal high water table is at a depth of 2.5 to 3.5 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, and a cropping system that includes rotational hay and pasture help to prevent excessive soil loss.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness, this soil is poorly suited to septic tank absorption fields. This limitation can be overcome by constructing a mound of suitable filtering material. In places the effluent also can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of wetness, this soil is only moderately suited to dwellings with basements. It is suited to dwellings without basements. The wetness can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

This soil is only moderately suited to local roads and streets because of frost action. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3L.

## Ad—Altdorf mucky silt loam, 0 to 2 percent slopes

This deep, nearly level, poorly drained soil is in depressions and drainageways on ground moraines. It is subject to ponding. Most areas are long and narrow or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is black mucky silt loam about 3 inches thick. The subsurface layer is dark gray, mottled silt loam about 5 inches thick. The next layer is dark grayish brown and dark gray, mottled silty clay loam and silt loam about 4 inches thick. The subsoil is reddish brown and dark red, mottled clay about 32 inches thick. The substratum to a depth of about 60 inches is multicolored clay loam. In some places the surface layer is silt loam, loam, sandy loam, or muck. In other places the subsoil and substratum are loam or sandy clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Dolph soils in the slightly higher landscape positions. These soils make up about 5 to 15 percent of individual mapped areas.

Permeability is slow in this Altdorf soil. Surface runoff is slow to ponded. Available water capacity is high. The organic matter content in the surface layer is high or very high. During wet periods a seasonal high water table is within a depth of 1 foot.

Many areas of this soil are used as woodland. Some are used for pasture or wildlife habitat.

Undrained areas are generally unsuitable as cropland because of wetness and because of frost late in spring and early in fall. If drained, this soil is suited to oats and to clover and timothy for rotational hay and pasture. It is generally unsuited to corn because of the hazard of freezing. Land smoothing and surface drains can help to remove excess water. Cleared areas in intermittent drainageways can be used as grassed waterways.

Drained areas of this soil are suited to permanent pasture and hayland. Proper stocking rates, pasture

renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the ponding and the slow permeability, this soil is generally unsuited to septic tank absorption fields. It is generally unsuited to dwellings because of the ponding and the shrink-swell potential. Overcoming these limitations is difficult.

This soil is poorly suited to local roads because of the shrink-swell potential, low soil strength, and the ponding. The shrink-swell potential and low soil strength can be overcome by excavating the soil and replacing it with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement. The ponding can be overcome by removing the surface water through culverts and ditches or by building on fill material, which raises the road above the level of ponding. Installing culverts also helps to prevent road damage by equalizing the water on both sides of the road.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 3W.

## AmC—Amery silt loam, 5 to 15 percent slopes

This deep, gently sloping to moderately steep, well drained soil is on the tops and sides of knolls on ground moraines. Most areas are long and narrow or oval and range from about 4 to 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 4 inches thick. The next layer is dark brown silt loam about 4 inches thick. Below that is brown and dark brown loam and fine sandy loam about 16 inches thick. The subsoil is dark reddish brown sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is reddish brown gravelly sandy loam. In some places the upper part of the soil is loam or sandy loam. In other places the slope is less than 5 or more than 15 percent.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils in the slightly lower landscape positions. Also included are areas of Amery soils that have cobbles and stones in the surface layer or that have pockets or strata of sand, gravel, or cobbles in the substratum. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderately slow in the subsoil of this Amery soil and extremely slow or slow in the substratum. Surface runoff is slow or medium. Available water capacity is moderate. The organic matter content in the surface layer is moderately low or moderate.

Many areas of this soil are used as woodland. Some are used as cropland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a moderate or severe hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, diversions, contour farming, and a cropping system that includes rotational hay and pasture help to prevent excessive soil loss. Proper management of crop residue and green manure crops help to control water erosion, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the moderate permeability and the slope, this soil is only moderately suited to septic tank absorption fields. The moderate permeability can be overcome by constructing a mound of suitable filtering material or by increasing the size of the absorption field. The slope can be reduced by cutting and filling, or a trench absorption system can be installed on the contour.

Because of the slope, this soil is only moderately

suited to dwellings. The slope can be reduced by cutting and filling, or the dwellings can be designed so that they conform to the natural slope of the land.

This soil is only moderately suited to local roads and streets because of the slope and frost action. The slope can be reduced by cutting and filling to shape the roadway. The potential for frost action can be reduced by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIe. The woodland ordination symbol is 4L.

## CbA—Cable silt loam, 0 to 3 percent slopes, stony

This deep, nearly level and gently sloping, poorly drained and very poorly drained soil is in depressions and drainageways on ground moraines. It is subject to ponding. Stones and cobbles are in the surface layer in most places. Most areas are long and narrow and range from about 4 to 160 acres in size.

Typically, the surface layer is very dark brown silt loam about 3 inches thick. The subsurface layer is dark gray, mottled silt loam about 4 inches thick. The subsoil is about 20 inches thick. It is grayish brown and mottled. It is silt loam in the upper part and loam in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled gravelly sandy loam. In some places the upper part of the soil is muck, loam, or sandy loam. In other places the substratum is loam, sandy clay loam, or clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor and Withee soils in the higher landscape positions. These soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately slow in the subsoil of this Cable soil and moderately slow in the substratum. Surface runoff is very slow or ponded. Available water capacity is moderate. The organic matter content in the surface layer is moderate or high. During wet periods a seasonal high water table is within a depth of 1 foot.

Most areas of this soil are used as woodland. A few areas are used for pasture, wildlife habitat, or cropland.

This soil is generally unsuited to use as cropland because of wetness and the stones. If the soil is drained and the stones are removed, it is suited to oats and to clover and timothy for rotational hay and pasture. It is generally unsuited to corn because of the hazard of freezing. Land smoothing and surface drains can help to remove the excess water. Cleared areas that are in intermittent drainageways should be used as grassed waterways.

Some areas can be cleared of stones, drained, and renovated for permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The use of planting and harvesting equipment is limited by wetness and the cobbles and stones. Forest regeneration is limited to natural seeding or hand planting. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the ponding and the restricted permeability, this soil is generally unsuited to septic tank absorption fields. Because of the ponding, it is generally unsuited to dwellings. Overcoming these limitations is difficult.

This soil is poorly suited to local roads because of ponding and frost action. The ponding can be overcome by removing the surface water through culverts and ditches or by adding fill material, which raises the road above the ponding level. Culverts also help to prevent road damage by equalizing the water level on each side of the road. The potential for frost action can be reduced by excavating the upper part of the soil and replacing it with coarse textured base material, such as sand or gravel.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 2X.

## Ch—Cathro muck, 0 to 1 percent slopes

This deep, nearly level, very poorly drained soil is in drainageways and depressions on ground moraines, glacial lake plains, and outwash plains. It is subject to ponding. Most areas are irregular in shape or long and narrow and range from about 4 to 300 acres in size.

Typically, the organic layer is muck about 28 inches thick. It is dark reddish brown in the upper part and black and dark reddish brown in the lower part. The upper part of the substratum is dark gray silt loam about 5 inches thick. The lower part to a depth of about 60 inches is gray, mottled loam. In some places

the surface layer is peat. In other places the substratum is sand, loamy sand, gravelly sand, gravelly loamy sand, sandy loam, sandy clay loam, or clay loam. In some areas the organic layer is less than 16 or more than 51 inches thick.

Included with this soil in mapping are small areas of the poorly drained Cable, Dancy, Fordum, Marshfield, Minocqua, Newson, and Sherry soils in the slightly higher landscape positions. These soils formed in silty, loamy, or sandy deposits. They make up about 5 to 15 percent of individual mapped areas.

Permeability is moderately slow to moderately rapid in the organic layer of this Cathro soil and moderately slow or moderate in the loamy and silty substratum. Surface runoff is very slow or ponded. Available water capacity is very high. The organic matter content in the organic layer is very high. During wet periods a seasonal high water table is within a depth of 1 foot.

Many areas of this soil are used as wildlife habitat. Some are used as woodland.

Undrained areas are generally unsuited to cultivated crops because of wetness and because of frost late in spring and early in fall. Most areas cannot be drained because of a lack of adequate outlets, but some areas can be drained by open ditches. Drained areas are suited to oats and to grasses and legumes for rotational hay and pasture. This soil is generally unsuited to corn because of the hazard of freezing. If drained and used as cropland, the soil is subject to subsidence and soil blowing. A system of controlled drainage that keeps the water table directly below the root zone of the crops reduces the susceptibility to subsidence and soil blowing. Field windbreaks, wind stripcropping, and cover crops also help to control soil blowing.

Drained areas of this soil are suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, reforestation is limited to natural regeneration. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets, mainly because of ponding, subsidence, and frost action. Overcoming these limitations is difficult.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 7W.

## CkA—Chetek sandy loam, 0 to 2 percent slopes

This deep, nearly level, somewhat excessively drained soil is on broad or narrow flats on stream terraces and outwash plains. Most areas are irregular in shape and range from about 10 to 640 acres in size.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 17 inches thick. It is dark brown sandy loam in the upper part, reddish brown gravelly sandy loam in the next part, and yellowish red gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is reddish yellow gravelly coarse sand. In some places the surface layer is silt loam, loam, or loamy sand. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the moderately well drained Mahtomedi and Scott Lake soils in the slightly lower landscape positions. Also included are small areas of the excessively drained Mahtomedi and well drained Rosholt soils in landscape positions similar to those of the Chetek soil and small areas of Chetek soils that have cobbles in the surface layer and subsoil. The surface layer and subsoil of the Mahtomedi soils have more sand and less silt and clay than those of the Chetek soil. The upper part of the Rosholt soils has more silt and less sand than that of the Chetek soil. Also, the Rosholt soils have a thicker solum. Included soils make up 5 to 15 percent of individual mapped areas.

Permeability is moderate to rapid in the upper part of this Chetek soil and rapid in the lower part. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderate or moderately low.

Many areas of this soil are used as cropland. Some are used as woodland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. It tends to be droughty during periods of low rainfall and is subject to soil blowing. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, and field windbreaks help to prevent excessive

soil loss. A cropping sequence that includes rotational hay or pasture also is effective in controlling soil blowing. Proper management of crop residue and green manure crops help to prevent excessive soil loss, increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is suited to dwellings and to local roads and streets. It can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIs. The woodland ordination symbol is 6A.

## CkB—Chetek sandy loam, 2 to 6 percent slopes

This deep, gently sloping, somewhat excessively drained soil is on broad or narrow, convex or concave flats or knolls on stream terraces and outwash plains. Most areas are irregular in shape and range from about 10 to 400 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 5 inches thick. The subsoil is about 10 inches thick. It is dark brown sandy loam in the upper part and brown gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand. In some places the surface layer is silt loam, loam, or loamy sand. In other places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the moderately well drained Mahtomedi and Scott Lake soils in the slightly lower landscape positions. Also included are small areas of the excessively drained Mahtomedi and well drained Rosholt soils in landscape positions similar to those of the Chetek soil and small areas of Chetek soils that have cobbles in the surface layer and subsoil. The surface layer and subsoil of the Mahtomedi soils have more sand and less silt and clay than those of the Chetek soil. The upper part of the Rosholt soils has more silt and less sand than that of the Chetek soil. Also, the Rosholt soils have a thicker solum. Included soils make up 5 to 15 percent of individual mapped areas.

Permeability is moderate to rapid in the upper part of this Chetek soil and rapid in the lower part. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderate or moderately low.

Many areas of this soil are used as cropland. Some are used as woodland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If cultivated crops are grown, the hazard of water erosion is slight or moderate. Also, soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, and contour farming help to prevent excessive water erosion. Wind stripcropping, cover crops, conservation tillage, and field windbreaks help to prevent excessive soil blowing. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion and soil blowing. The soil tends to be droughty during periods of low rainfall. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is suited to dwellings and to local roads and streets. It can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIe. The woodland ordination symbol is 6A.

## CkC—Chetek sandy loam, 6 to 15 percent slopes

This deep, somewhat excessively drained soil is on the sides of knolls and ridges on stream terraces and outwash plains. It is sloping and moderately steep or is rolling and hilly. Most areas are irregular in shape and range from about 4 to 40 acres in size.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The subsoil is about 11 inches thick. It is dark brown sandy loam in the upper part and strong brown gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is reddish yellow gravelly sand. In some places the upper part of the soil is silt loam, loam, or loamy sand. In other places the slope is less than 6 or more than 15 percent.

Included with this soil in mapping are small areas of the well drained Kennan and excessively drained Mahtomedi soils. These soils are in landscape positions similar to those of the Chetek soil. Kennan soils are underlain by loamy sand glacial till. The surface layer and subsoil of the Mahtomedi soils have more sand and less silt and clay than those of the Chetek soil. Also included are small areas of Chetek soils that have cobbles in the surface layer and subsoil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate to rapid in the upper part of this Chetek soil and rapid in the lower part. Surface runoff is medium. Available water capacity is low. The organic matter content in the surface layer is moderately low or moderate.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If cultivated crops are grown, the hazard of water erosion is moderate. Also, soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, contour farming, and a cropping system that includes rotational hay and pasture help to prevent excessive water erosion. Wind stripcropping, cover crops, conservation tillage, and field windbreaks help to prevent excessive soil blowing. The soil tends to be droughty during periods of low rainfall. Most irrigation equipment does not function properly on this soil because of the slope. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, this soil is only moderately suited to dwellings. The slope can be reduced by cutting and filling, or the dwellings can be designed so that they conform to the natural slope of the land.

Because of the slope, this soil is only moderately suited to local roads and streets. The slope can be reduced by cutting and filling to shape the roadway.

The land capability classification is IVe. The woodland ordination symbol is 6A.

## CkE—Chetek sandy loam, 15 to 30 percent slopes

This deep, moderately steep and steep, somewhat excessively drained soil is on the sides of hills and on escarpments on stream terraces and outwash plains. Most areas are long and narrow or irregular in shape and range from about 4 to 20 acres in size.

Typically, the surface layer is very dark brown sandy loam about 3 inches thick. The subsurface layer is brown sandy loam about 4 inches thick. The subsoil is about 17 inches thick. It is dark brown sandy loam in the upper part and strong brown gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some places the upper part of the soil is loam or loamy sand. In other places the slope is less than 15 or more than 30 percent.

Included with this soil in mapping are small areas of the well drained Kennan and excessively drained Mahtomedi soils. These soils are in landscape positions similar to those of the Chetek soil. Kennan soils are underlain by loamy sand glacial till. The surface layer and subsoil of the Mahtomedi soils have more sand and less silt and clay than those of the Chetek soil. Also included are small areas of Chetek soils that have cobbles in the surface layer and

subsoil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate to rapid in the upper part of this Chetek soil and rapid in the lower part. Surface runoff is rapid. Available water capacity is low. The organic matter content in the surface layer is moderately low or moderate.

Many areas of this soil are used as woodland. Some are used for pasture, and a few are used as cropland.

This soil is generally unsuited to row crops because of the low available water capacity and a severe hazard of water erosion. The less sloping areas are suited to small grain and to grasses and legumes for rotational hay and pasture. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, contour farming, and a cropping system that includes rotational hay and pasture help to prevent excessive soil loss. The soil tends to be droughty during periods of low rainfall. Irrigation equipment does not function properly on this soil because of the slope. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Slope and seedling survival are the main management concerns. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion. Seedling survival on the steeper slopes facing south or west can be improved by carefully planting vigorous nursery stock. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the slope, this soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets. This limitation can be overcome by cutting and filling. Also, a trench absorption system can be installed on the contour in some areas. Although this soil can readily absorb the effluent in septic tank absorption fields, it does not adequately filter it. The poor filtering capacity can result in the pollution of ground water. Dwellings can be designed so that they conform to the natural slope of the land, and roads can be constructed in the less sloping areas.

The land capability classification is VIe. The woodland ordination symbol is 6R.

## Da—Dancy sandy loam, 0 to 2 percent slopes

This deep, nearly level, poorly drained soil is in depressions and drainageways on ground moraines. It is subject to ponding. Most areas are long and narrow or irregular in shape and range from about 4 to 400 acres in size.

Typically, the surface layer is black sandy loam about 4 inches thick. The subsurface layer is gray, mottled loamy sand about 6 inches thick. The next layer is gray and brown, mottled loamy sand and sandy loam about 11 inches thick. The subsoil is light grayish brown, mottled loam about 9 inches thick. Below that is dark grayish brown, mottled loam about 11 inches thick. The substratum to a depth of about 60 inches is multicolored sandy loam. In some places the surface layer is muck, mucky sandy loam, loamy sand, or mucky loamy sand. In other places the upper part of the soil is muck, silt loam, loam, or sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Meadland and Rockers soils in the higher landscape positions. Also included are areas of Dancy soils that have cobbles and stones in the surface layer. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderately rapid in the upper part of this Dancy soil and moderate in the lower part. Surface runoff is slow to ponded. Available water capacity is moderate. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal high water table is within a depth of 1 foot.

Most areas of this soil are used as woodland. A few are used as cropland or pasture.

Undrained areas are generally unsuitable as cropland because of wetness and because of frost late in spring and early in fall. If drained, this soil is suited to oats and to clover and timothy for rotational hay and pasture. It is generally unsuited to corn because of the hazard of freezing. If drained, it is subject to soil blowing. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, cover crops, wind stripcropping, and a cropping system that includes rotational hay and pasture help to prevent excessive soil loss. Cleared areas in intermittent drainageways can be used as grassed waterways.

Drained areas of this soil are suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the ponding, this soil is generally unsuited to septic tank absorption fields and dwellings. Overcoming this hazard is difficult.

This soil is poorly suited to local roads because of the ponding and frost action. The ponding can be overcome by removing the surface water through culverts and ditches or by adding fill material, which raises the roads above the ponding level. Culverts also help to prevent road damage by equalizing the water level on each side of the road. The potential for frost action can be reduced by excavating the upper part of the soil and replacing it with coarse textured base material, such as sand or gravel.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 3W.

## DoA—Dolph silt loam, 0 to 3 percent slopes

This deep, nearly level and gently sloping, somewhat poorly drained soil is in small, slightly concave or convex areas on plains on ground moraines. Most areas are irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is black silt loam about 3 inches thick. The subsurface layer is brown, mottled silt loam about 3 inches thick. The next layer is about 9 inches thick. It is mottled. It is brown and dark brown silt loam in the upper part and reddish brown and brown silty clay loam and silt loam in the lower part. The subsoil is dark red and dark reddish brown, mottled clay about 22 inches thick. The substratum to a depth of about 60 inches is dark reddish brown, mottled clay loam. In some places the upper part of the soil is loam or sandy loam. In other places the subsoil and substratum are loam or sandy clay loam.

Included with this soil in mapping are small areas of the poorly drained Altdorf soils in the slightly lower landscape positions. Also included are small areas of the somewhat poorly drained Rietbrock soils in landscape positions similar to those of the Dolph soil and small areas of Dolph soils that have cobbles and stones in the surface layer. The subsoil and substratum of the Rietbrock soils have less clay than those of the Dolph soil. Also, these soils are underlain by bedrock at a depth of 40 to 60 inches. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is slow in this Dolph soil. Surface runoff also is slow. Available water capacity is high. The organic matter content in the surface layer is moderate or high. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as woodland or pasture. A few are used as cropland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Unless the soil is adequately drained, excess water limits the choice of crops or results in crop damage in most years. The wetness also delays field preparation, planting, or harvest. Land smoothing and surface drains can help to remove excess water.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seeding mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and the slow permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can

be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet. On sites for dwellings without basements, a high shrink-swell potential is a limitation. It can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel.

This soil is poorly suited to local roads and streets because of low soil strength, frost action, and the shrink-swell potential. These limitations can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by increasing the thickness of the pavement and of the base or subbase material.

The land capability classification is IIw. The woodland ordination symbol is 2C.

## DuB—Dunnville fine sandy loam, 1 to 4 percent slopes

This deep, nearly level and gently sloping, moderately well drained soil is on knolls and slightly convex stream terraces. Some areas are subject to rare flooding of brief duration. Most areas are long and narrow or irregular in shape and range from about 4 to 160 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is dark reddish brown fine sandy loam about 18 inches thick. The next layer is reddish brown loamy fine sand about 10 inches thick. The upper part of the substratum is yellowish brown, mottled fine sand. The lower part to a depth of about 60 inches is brown gravelly sand. In places the upper part of the soil is loamy fine sand, loam, or silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Sturgeon soils in the lower landscape positions. Also included are areas of Dunnville soils that have a seasonal high water table at a depth of more than 6 feet. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Dunnville soil and rapid in the substratum. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal water table is at a depth of 3 to 6 feet.

Some areas of this soil are used as cropland or pasture. A few areas have been planted to pine trees, support natural vegetation, or have been used as building sites. Some areas are used as woodland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If cultivated crops are grown, water erosion is a slight hazard. Also, soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, and contour stripcropping help to prevent excessive water erosion. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Wind stripcropping, cover crops, conservation tillage, and field windbreaks help to prevent excessive soil blowing. The soil tends to be droughty during periods of low rainfall. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb the effluent but cannot adequately filter it. The poor filtering capacity can result in the pollution of ground water. In some areas both of the limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

This soil is poorly suited to dwellings because it is subject to rare flooding. The hazard of flooding can be reduced by raising the site elevation through filling or by constructing a diversion or dike, which can divert water away from the dwelling.

Because of the rare flooding, this soil is only moderately suited to local roads and streets. The hazard of flooding can be reduced by using fill material to construct roads above the flooding level or by installing larger bridges and culverts to permit the floodwater to drain away.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

## FeC—Fenwood silt loam, 6 to 12 percent slopes

This deep, sloping, well drained soil is on the sides of knolls and ridges on uplands. Most areas are long and narrow or irregular in shape and range from about 4 to 160 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The next layer is dark brown and brown loam about 10 inches thick. The subsoil is about 19 inches thick. It is dark brown. It is loam in the upper part and gravelly loam in the lower part. Below this is dark brown very cobbly loam about 6 inches thick. Fractured, hard igneous and metamorphic bedrock is at a depth of about 42 inches. The depth to hard bedrock ranges from 40 to 60 inches. In places the surface layer is loam or sandy loam. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Rietbrock soils in the lower landscape positions and small areas of Mosinee soils. Mosinee soils are in landscape positions similar to those of the Fenwood soil. They have more sand and less silt and clay in the upper part than the Fenwood soil. Also included are small areas of Fenwood soils that have bedrock at a depth of more than 60 inches, in which the surface layer and upper part of the subsoil have been removed by erosion, or that have cobbles and stones in the surface layer; areas of soils that have bedrock at a depth of less than 40 inches or that have a perched seasonal high water table at a depth of 3 to 5 feet; and areas of bedrock outcrop. Inclusions make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate in this Fenwood soil. Surface runoff is medium. Available water capacity is moderate. The organic matter content in the surface layer is moderate.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. Construction of terraces and diversions is limited by the gravelly and cobbly subsoil and the bedrock. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the depth to bedrock, seepage of effluent into the fractures and crevices in the bedrock, and the moderate permeability, this soil is only moderately suited to septic tank absorption fields. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of the shrink-swell potential and the slope, this soil is only moderately suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the depth to bedrock, the slope, and the shrink-swell potential. The shrink-swell potential can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel. The slope can be reduced by cutting and filling with suitable power equipment, or the dwellings can be designed so that they conform to the natural slope of the land. The depth to bedrock can be overcome by excavating the bedrock, by raising the site by filling, or by constructing dwellings without basements or with partially exposed basements.

This soil is only moderately suited to local roads and streets because of the slope, frost action, and the shrink-swell potential. The slope can be reduced by cutting and filling. Cutting can expose the bedrock, which in turn can be removed by blasting, by using a jackhammer, or by using suitable power equipment. Frost action and the shrink-swell potential can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIe. The woodland ordination symbol is 3L.

## FeD—Fenwood silt loam, 12 to 20 percent slopes

This deep, moderately steep, well drained soil is on the sides of hills and ridges on uplands. Most areas are long and narrow and range from about 4 to 160 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark yellowish brown silt loam about 5 inches thick. Below that is brown and dark brown loam about 15 inches thick. The subsoil is about 20 inches thick. It is dark brown. It is gravelly sandy clay loam in the upper part and very cobbly loam in the lower part. Fractured, hard igneous and metamorphic bedrock is at a depth of about 43 inches. The depth to hard bedrock ranges from 40 to 60 inches. In places the surface layer is loam or sandy loam. In some areas the slope is less than 12 or more than 20 percent.

Included with this soil in mapping are small areas of the Mosinee soils. These soils are in landscape positions similar to those of the Fenwood soil. They have more sand and less silt and clay in the upper part than the Fenwood soil. Also included are small areas where the upper part of the Fenwood soil has been removed by erosion or where cobbles and stones are in the surface layer, areas of soils that have bedrock at a depth of less than 40 inches, and areas of rock outcrop. Inclusions make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate in this Fenwood soil. Surface runoff is rapid. Available water capacity is moderate. The organic matter content in the surface layer also is moderate.

Many areas are used as woodland. Some are used for pasture. A few are used as cropland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a severe hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. Construction of terraces and diversions is limited by the cobbly subsoil and the bedrock. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Slope and plant competition following the harvest also are management concerns. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion. Seedling survival on the steeper slopes facing south or west can be improved by carefully planting vigorous nursery stock. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the slope, this soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets. Overcoming this limitation is difficult because of the limited depth to bedrock.

The land capability classification is IVe. The woodland ordination symbol is 3R.

## FfC—Fenwood silt loam, 2 to 15 percent slopes, stony

This deep, gently sloping to moderately steep, well drained soil is on the tops and sides of knolls and ridges on uplands. Many cobbles and stones are in the surface layer. Most areas are long and narrow or irregular in shape and range from about 4 to 240 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. Below that is dark brown silt loam about 6 inches thick. The next layer is 12 inches thick. It is brown and dark yellowish brown. It is silt loam in the upper part and loam in the lower part. The subsoil is about 25 inches thick. It is dark brown. It is gravelly loam in the upper part and cobbly loam in the lower part. Below this is dark brown very cobbly loam about 9 inches thick. Fractured igneous and metamorphic bedrock is at a depth of about 45 inches. The depth to hard bedrock ranges from 40 to 60 inches. In some places the upper part of the soil is loam or sandy loam. In other places the slope is more than 15 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Rietbrock soils in the lower landscape positions. Also included are small areas of Marathon soils in landscape positions similar

to those of the Fenwood soil, small areas of Fenwood soils that have bedrock at a depth of more than 60 inches or that do not have cobbles and stones in the surface layer, areas of soils that have bedrock at a depth of less than 40 inches or that have a seasonal high water table at a depth of 3 to 5 feet, and areas of bedrock outcrop. Marathon soils have less clay in the subsoil than the Fenwood soil. Inclusions make up 10 to 15 percent of individual mapped areas.

Permeability is moderate in this Fenwood soil. Available water capacity also is moderate. The organic matter content in the surface layer is moderate or high.

Many areas of this soil are used as woodland. Some are used for unimproved pasture, and a few are used as wildlife habitat.

This soil is generally unsuited to cultivated crops, hay, and pasture because of cobbles, stones, and rock outcrops.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the stones and rock outcrops. Because of low soil strength, it also is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the depth to bedrock, seepage of effluent into the fractures and crevices in the bedrock, and the moderate permeability, this soil is only moderately suited to septic tank absorption fields. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of the shrink-swell potential, the slope, and the large stones, this soil is only moderately suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the depth to bedrock, the slope, and the shrink-swell potential. The shrink-swell potential can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel. The slope can be reduced by cutting and filling with suitable power equipment, or the dwellings can be designed so they conform to the natural slope of the land. The large stones can be removed by mechanical means, or the elevation of the site can be raised with coarse textured material, such as sand or gravel. The depth to bedrock can be overcome by excavating the bedrock, by raising the site with fill material, or by constructing dwellings without basements or with partially exposed basements.

This soil is only moderately suited to local roads and streets because of the slope, frost action, and the shrink-swell potential. The slope can be reduced by cutting and filling. Cutting can expose the bedrock, which in turn can be removed by blasting, by using a jackhammer, or by using suitable power equipment. Frost action and the shrink-swell potential can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IVe. The woodland ordination symbol is 3X.

## FfE—Fenwood silt loam, 15 to 30 percent slopes, stony

This deep, moderately steep and steep, well drained soil is on the sides of hills and ridges on uplands. Many cobbles and stones are in the surface layer. Most areas are long and narrow or irregular in shape and range from about 4 to 120 acres in size.

Typically, the surface layer is very dark brown silt loam about 4 inches thick. Below this is dark brown silt loam about 4 inches thick. The next layer is about 12 inches thick. It is yellowish brown and dark yellowish brown. It is loam in the upper part and gravelly loam in the lower part. The subsoil is dark yellowish brown cobbly loam about 13 inches thick. The next layer is dark yellowish brown very cobbly loam about 8 inches thick. Fractured igneous and metamorphic bedrock is at a depth of about 41 inches. The depth to hard bedrock ranges from 40 to 60 inches. In some places the upper part of the soil is loam or sandy loam. In other places the slope is less than 15 or more than 30 percent.

Included with this soil in mapping are small areas of Fenwood soils that do not have cobbles and stones in the surface layer. Also included are areas of soils that have bedrock at a depth of less than 40 inches and areas of bedrock outcrop. Inclusions make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate in this Fenwood soil. Available water capacity also is moderate. The organic matter content in the surface layer is moderate or high.

Many areas of this soil are used as woodland. Some are used for unimproved pasture, and a few are used as wildlife habitat.

This soil is unsuited to cultivated crops, hay, and pasture because of the cobbles and stones, the rock outcrops, and the slope.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the rock outcrops, the stones, and the slope. Seedling survival on the steeper slopes facing south or west can be improved by carefully planting vigorous nursery stock.

Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the slope, this soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets. Overcoming this limitation is difficult because any excavation of the soil exposes the underlying bedrock.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

## FgB—Fenwood-Rozellville silt loams, 2 to 6 percent slopes

These deep, gently sloping, well drained soils are on broad knolls and ridgetops on uplands. These soils cannot be distinguished from each other by their surface features. Areas generally are irregular in shape and range from about 10 to 320 acres in size. They are 40 to 50 percent Fenwood silt loam and 35 to 45 percent Rozellville silt loam. The two soils occur as areas so intricately intermingled or so small that separating them in mapping is not practical.

Typically, the Fenwood soil has a very dark grayish brown silt loam surface layer about 8 inches thick. The subsurface layer is grayish brown and brown loam about 4 inches thick. The next layer is brown, dark yellowish brown, and dark brown loam about 12 inches thick. The subsoil is about 19 inches thick. It is dark brown. It is gravelly loam in the upper part and cobbly loam in the lower part. Fractured igneous and metamorphic bedrock is at a depth of about 43 inches. The depth to hard bedrock ranges from 40 to 60 inches. In places the surface layer is loam or sandy loam.

Typically, the Rozellville soil has a very dark grayish brown silt loam surface layer about 7 inches thick. The next layer is brown and dark brown silt loam about 7 inches thick. The subsoil is about 21 inches thick. It is dark brown clay loam in the upper part and yellowish brown sandy loam in the lower part. The substratum to a depth of about 60 inches is olive brown gravelly loam. In places the surface layer is loam or sandy loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Rietbrock and Withee soils in the slightly lower landscape positions. Also included are small areas of the moderately well drained Loyal and well drained Marathon and Mosinee soils in landscape positions similar to those of the Fenwood and Rozellville soils, areas of the Fenwood and Rozellville soils that have cobbles and stones in the surface layer, areas of soils that have a seasonal high water table at a depth of 3 to 5 feet, and areas of bedrock outcrop. Loyal soils are underlain by loamy glacial till at a depth of 60 inches or more. The subsoil of the Marathon soils has less clay than that of the Rozellville soil. Also, the Marathon soils have more gravel in the lower part. The upper part of the Mosinee soils has more sand and less silt and clay than that of the Fenwood soil. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate in these Fenwood and Rozellville soils. Surface runoff is medium. Available water capacity is moderate in the Fenwood soil and high in the Rozellville soil. The organic matter content is moderate in the surface layer of both soils.

Many areas of these soils are used as cropland. Some are used as woodland, and a few are used for pasture.

These soils are suited to corn and small grain and to grasses and legumes for rotational hay and pasture. They also are suited to ginseng. If these soils are cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. The construction of terraces and diversions on the Fenwood soil is limited by the cobbly subsoil and the depth to bedrock. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to prevent excessive soil loss, help to maintain or increase the organic matter content, and increase the rate of water infiltration.

These soils are suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

These soils are suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

These soils are suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

The Fenwood soil is only moderately suited to septic tank absorption fields because of the depth to

bedrock, seepage of the effluent into fractures and crevices in the bedrock, and the moderate permeability. Because of moderate permeability, the Rozellville soil is only moderately suited to septic tank absorption fields. These limitations can be overcome by constructing a mound of suitable filtering material.

The Rozellville soil is suited to dwellings. Because of the shrink-swell potential, the Fenwood soil is only moderately suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the depth to bedrock and the shrink-swell potential. The shrink-swell potential can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel. The depth to bedrock can be overcome by ripping and excavating the bedrock with suitable power equipment, by adding fill material to raise the site, or by constructing dwellings with only partially exposed basements.

The Fenwood soil is only moderately suited to local roads and streets because of frost action and the shrink-swell potential. Because of frost action, the Rozellville soil is only moderately suited to local roads and streets. These limitations can be overcome by replacing the upper part of the soils with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3L.

## Fh—Fordum silt loam, 0 to 1 percent slopes

This deep, nearly level, poorly drained and very poorly drained soil is in depressions, overflow channels, and low areas on flood plains. It also occurs as islands in large rivers. Many areas are dissected by old stream channels. This soil is subject to ponding and frequent flooding of long duration. Most areas are long and narrow or irregular in shape and range from about 4 to 200 acres in size.

Typically, the surface layer is very dark brown silt loam about 6 inches thick. The upper part of the substratum is dark gray, mottled silt loam and fine sandy loam. The lower part to a depth of about 60 inches is gray sand. In some places the surface layer is muck, mucky silt loam, mucky loam, loam, mucky fine sandy loam, fine sandy loam, mucky sandy loam, or sandy loam.

Included with this soil in mapping are small areas of Cable, Cathro, Dancy, Marshfield, Minocqua, Newson, Sherry, and Sturgeon soils. Cable, Cathro, Dancy, Marshfield, Minocqua, Newson, and Sherry soils are in areas adjacent to streams and rivers where little or no alluvial material has been deposited. The somewhat poorly drained Sturgeon soils are in the slightly higher landscape positions. Also included are areas along the major rivers where rocks, sand, and gravel are exposed. Inclusions make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the loamy upper part of this Fordum soil and rapid in the sandy lower part. Available water capacity is moderate. The organic matter content is high or very high in the surface layer. During wet periods a seasonal high water table is within a depth of 1 foot.

Many areas of this soil are used as woodland. Some are used as wildlife habitat or unimproved pasture.

This soil is unsuited to cultivated crops because of wetness and the frequent flooding. Most areas cannot be drained or protected from flooding.

This soil is generally unsuited to permanent pasture and hayland because of wetness and the frequent flooding. A few areas can be used for pasture, but forage species are restricted to such plants as reed canarygrass. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Mainly because of the flooding and ponding, this soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets. Overcoming these hazards is difficult.

The land capability classification is VIw. The woodland ordination symbol is 2W.

## FnB—Freeon silt loam, 2 to 6 percent slopes

This deep, gently sloping, moderately well drained soil is on broad knolls and ridgetops on ground moraines. Most areas are irregular in shape and range from about 4 to 300 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is about 17

inches thick. It is mottled. It is brown and strong brown silt loam in the upper part and brown sandy loam in the lower part. The subsoil is reddish brown sandy loam about 24 inches thick. The substratum to a depth of about 60 inches is brown sandy loam. In some places the upper part of the soil is loam or sandy loam. In other places the substratum is sandy clay loam, clay loam, loamy sand, or gravelly loamy sand. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor soils in the lower positions on the landscape. Also included are small areas of Freeon soils that have bedrock at a depth of 40 to 60 inches or have pockets or strata of sand and gravel in the substratum. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the silty upper part of this Freeon soil and very slow in the substratum. Surface runoff is medium. Available water capacity is moderate. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal high water table is at a depth of 2.0 to 3.5 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to prevent excessive soil loss, help to maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of wetness, this soil is poorly suited to dwellings with basements. It is only moderately suited to dwellings without basements because of the wetness. The wetness can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet, or the site elevation can be raised by filling.

This soil is only moderately suited to local roads and streets because of the wetness and frost action. The wetness can be overcome by using fill material to raise the roadbed above the level of wetness or by increasing the thickness of the subbase. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3D.

## FnC—Freeon silt loam, 6 to 12 percent slopes

This deep, sloping, moderately well drained soil is on the tops and sides of knolls and ridges on ground moraines. Most areas are long and narrow or irregular in shape and range from about 4 to 120 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The next layer is about 12 inches thick. It is brown and dark yellowish brown silt loam in the upper part and dark yellowish brown and brown, mottled silt loam in the lower part. The subsoil is reddish brown, mottled loam, gravelly loam, and gravelly sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown gravelly sandy loam. In some places the upper part of the soil is loam or sandy loam. In other places the substratum is sandy clay loam, clay loam, loamy sand, or gravelly loamy sand. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Amery soils in the slightly higher landscape positions and the somewhat poorly drained Magnor soils in lower positions. Also included are small areas of Freeon soils that have bedrock at a

depth of 40 to 60 inches or that have pockets or strata of sand and gravel in the substratum. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the silty upper part of this Freeon soil and very slow in the substratum. Surface runoff is medium. Available water capacity is moderate. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal high water table is at a depth of 2.0 to 3.5 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, diversions, terraces, and contour stripcropping help to prevent excessive soil loss.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of wetness, this soil is poorly suited to dwellings with basements. It is only moderately suited to dwellings without basements because of the wetness and slope. The wetness can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet, or the site elevation can be raised by filling. The slope can be reduced by cutting and filling, or the dwellings can be designed so that they conform to the natural slope of the land.

This soil is only moderately suited to local roads and streets because of the wetness, the slope, and frost action. The wetness can be overcome by using fill material to raise the roadbed above the level of wetness or by increasing the thickness of the subbase. The slope can be reduced by cutting and filling to shape the roadway. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

## GcB—Graycalm loamy sand, 2 to 6 percent slopes

This deep, gently sloping, somewhat excessively drained soil is in small, convex or concave areas on flats or knolls. It is on recessional moraines, glacial lake plains, or outwash plains. Most areas are circular or irregular in shape and range from about 4 to 160 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is dark brown and strong brown loamy sand about 17 inches thick. Between depths of 26 and 52 inches is yellowish brown loamy sand that has lamellae of brown fine sandy loam. The substratum to a depth of about 60 inches is brownish yellow sand. In some places the surface layer is sandy loam or sand. In other places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the moderately well drained Graycalm soils in the slightly lower landscape positions. Also included are areas of the moderately well drained Alban and excessively drained or moderately well drained Mahtomedi soils in landscape positions similar to those of this Graycalm soil. The upper part of the Alban soils has more silt and clay than that of the Graycalm soil. The lower part of the subsoil and the substratum of the Mahtomedi soils have more gravel than those of the Graycalm soil. Also, these soils do not have lamellae of fine sandy loam. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Graycalm soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderately low or low.

Many areas of this soil are used as cropland. Some are used as woodland, and a few are used for pasture.

This soil is suited to corn and small grain and to

grasses and legumes for rotational hay and pasture. If irrigated, it also is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. It tends to be droughty during periods of low rainfall and is subject to soil blowing. Where an adequate water supply is available, irrigation can supplement rainfall. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, and field windbreaks help to prevent excessive soil loss. A cropping system that includes rotational hay or pasture also is effective in controlling soil blowing. Proper management of crop residue and green manure crops help to prevent excessive soil loss, increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. The traction of some equipment used for planting and harvesting is limited when the upper part of the soil is dry.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is suited to dwellings and to local roads and streets. It can readily absorb the effluent in septic tank absorption fields but cannot adequately filter it. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 6S.

## Gm—Graycalm loamy sand, moderately well drained, 0 to 2 percent slopes

This deep, nearly level soil is in small, slightly concave areas on flats. It is on recessional moraines, glacial lake plains, or outwash plains. Most areas are circular or irregular in shape and range from about 4 to 200 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is dark brown and yellowish brown loamy sand about 16 inches thick. Between the depths of 25 and 49 inches is brown, mottled loamy sand that has lamellae of dark brown, mottled fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, mottled sand. In places the surface layer is sandy loam or sand.

Included with this soil in mapping are small areas of the somewhat excessively drained Graycalm soils in the slightly higher landscape positions and the somewhat poorly drained Meehan and Plover soils in the lower positions. Also included are small areas of the moderately well drained Alban and Mahtomedi soils in landscape positions similar to those of the Graycalm soil. The upper part of the Alban soils has more silt and clay and less sand than that of the Graycalm soil. The lower part of the subsoil and the substratum of the Mahtomedi soils have more gravel than those of the Graycalm soil. Also, these soils do not have lamellae of fine sandy loam. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Graycalm soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderately low or low. During wet periods a seasonal high water table is at a depth of 2.5 to 4.5 feet.

Many areas of this soil are used as cropland. Some are used for pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If irrigated, it also is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. It tends to be droughty during periods of low rainfall and is subject to soil blowing. Where an adequate water supply is available, irrigation can supplement rainfall. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, and field windbreaks help to prevent excessive soil loss. A cropping system that includes rotational hay or pasture also is effective in controlling soil blowing. Proper management of crop residue and green manure crops help to prevent excessive soil loss, increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. The traction of some equipment used for planting and harvesting is limited when the upper part of the soil is dry.

This soil is suited to the development of woodland

wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb the effluent but cannot adequately filter it. The poor filtering capacity can result in the pollution of ground water. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is only moderately suited to dwellings with basements. It is suited to dwellings without basements. The basement can be constructed above the level of wetness. Otherwise, the wetness can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

This soil is suited to local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 6S.

## Gr—Greenwood peat, 0 to 1 percent slopes

This deep, nearly level, very poorly drained soil is in bogs and depressions on ground moraines, outwash plains, and glacial lake plains. It is subject to ponding. Most areas are circular or irregular in shape and range from about 4 to 640 acres in size.

Typically, the organic layer is more than 60 inches thick. The surface layer is very dark grayish brown peat about 4 inches thick. Below that is very dark brown and dark reddish brown mucky peat. In most places sphagnum moss is growing on the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley and Oesterle soils in the higher landscape positions. These soils formed in loamy deposits underlain by sandy deposits. In places the sandy or loamy deposits are at a depth of 8 to 60 inches. Included soils make up about 5 to 10 percent of individual mapped areas.

Permeability is moderate or moderately rapid in this Greenwood soil. Available water capacity is very high. The organic matter content in the surface layer also is very high. During wet periods a seasonal high water table is within a depth of 1 foot.

Most areas of this soil are used as wildlife habitat. A few are used as woodland.

This soil is generally unsuited to cultivated crops and to permanent pasture and hayland because of extreme acidity, the seasonal high water table, and frost late in spring and early in fall. Where an adequate supply of water is available for protection from frost and for harvesting activities, the soil is suited to cranberries.

This soil is generally unsuited to trees. Because of extreme acidity, it does not support trees of merchantable size and quality.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is generally unsuited to septic tank absorption fields, to dwellings, and to local roads and streets because of subsidence, ponding, low soil strength, and frost action. Overcoming these limitations is difficult.

The land capability classification is VIIw in undrained areas. This soil is not assigned a woodland ordination symbol.

## GuB—Guenther loamy sand, 2 to 6 percent slopes

This deep, gently sloping, moderately well drained soil is on knolls in the uplands. Most areas are irregular in shape and range from about 4 to 40 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The upper part of the subsoil is dark brown and brown loamy sand about 17 inches thick. The next part is dark yellowish brown and brown, mottled loamy sand about 5 inches thick. The lower part is dark brown, mottled fine sandy loam about 6 inches thick. The substratum to a depth of about 60 inches is dark brown and brown, mottled gravelly loam. In some places the loamy sand in the upper part of the soil is less than 20 inches or more than 40 inches thick. In other places the upper part of the soil is sandy loam or sand. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the well drained Mosinee soils and the somewhat poorly drained Meadland and Rockers soils. Mosinee soils are in landscape positions similar to those of the Guenther soil. They have bedrock at a depth of 40 to 60 inches. Meadland and Rockers soils are in the slightly lower landscape positions. Also included are small areas of Guenther soils that have cobbles and stones in the surface layer, that have bedrock at a depth of less than 60 inches, or that do not have a seasonal high water table within a depth of 6 feet. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in the upper part of the subsoil in this Guenther soil and moderate in the lower part of

the subsoil and in the substratum. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer is low. During wet periods a seasonal high water table is at a depth of 2.5 to 6.0 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Water erosion is a slight hazard. Also, soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, and contour farming help to prevent excessive water erosion. Cover crops, wind stripcropping, conservation tillage, and field windbreaks help to prevent excessive soil blowing. A cropping system that includes rotational hay and pasture also helps to prevent excessive soil loss. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb the effluent but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of wetness and the shrink-swell potential, this soil is only moderately suited to dwellings with basements. It is suited to dwellings without basements. The wetness can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet. The shrink-swell potential can be overcome by removing the soil around and below the basement excavation and replacing it with coarse textured base material, such as sand or gravel.

This soil is suited to local roads and streets.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

## HtB—Hatley silt loam, 1 to 6 percent slopes

This deep, nearly level and undulating, somewhat poorly drained soil is in slight depressions and in areas adjacent to drainageways on terminal, recessional, and ground moraines. Most areas are irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The next layer is about 12 inches thick. It is mottled. It is brown and dark yellowish brown silt loam in the upper part and dark brown and dark yellowish brown loam in the lower part. The subsoil is dark brown, mottled loam and sandy loam about 20 inches thick. The substratum to a depth of about 60 inches is dark brown, mottled loamy sand. In places the upper part of the soil is sandy loam or loam.

Included with this soil in mapping are small areas of the well drained Kennan soils in the higher landscape positions. Also included are small areas of Oesterle soils in landscape positions similar to those of the Hatley soil, areas of Hatley soils that have bedrock at a depth of less than 60 inches or that have stones and boulders in the surface layer, and areas of soils that have a seasonal high water table at a depth of less than 1 foot or more than 3 feet during wet periods. Oesterle soils typically have a substratum of sand. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Hatley soil and moderate or moderately rapid in the substratum. Surface runoff is slow or medium. Available water capacity is moderate. The organic matter content in the surface layer is moderate. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as cropland. A few are used for pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, terraces, diversions, cover crops, and contour stripcropping help to prevent excessive soil loss. Excess water is a problem, mainly in the less sloping areas. It limits the choice of crops or results in crop damage in most years. It also delays

field preparation, planting, or harvest. Land smoothing, surface drains, and diversions help to remove this water.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness, this soil is poorly suited to septic tank absorption fields. In some places this limitation can be overcome by constructing a filtering mound of suitable material. In other places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3W.

## HyB—Hatley cobbly silt loam, 1 to 6 percent slopes, bouldery

This deep, nearly level and undulating, somewhat poorly drained soil is in slight depressions and in areas adjacent to drainageways on terminal, recessional, and ground moraines. Many boulders and stones are in the surface layer. Most areas are irregular in shape and range from about 10 to 320 acres in size.

Typically, the surface layer is very dark grayish brown cobbly silt loam about 5 inches thick. Below this is dark brown cobbly silt loam about 3 inches thick. The next layer is about 12 inches thick. It is mottled. It is brown and dark brown cobbly silt loam in the upper part and dark brown and brown loam in the lower part. The subsoil is dark brown, mottled loam about 12 inches thick. The next 12 inches is dark brown, mottled sandy loam. The substratum to a depth of about 60 inches is brown, mottled loamy sand. In places the upper part of the soil is sandy loam or loam.

Included with this soil in mapping are small areas of the well drained Kennan soils in the higher landscape positions. Also included are areas of soils that have a sand or gravelly sand substratum, that have bedrock within a depth of 60 inches, that have a seasonal high water table at a depth of less than 1 foot or more than 3 feet during wet periods, or that do not have boulders and stones in the surface layer. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Hatley soil and moderate or moderately rapid in the substratum. Available water capacity is moderate. The organic matter content in the surface layer is moderate or high. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Many areas of this soil are used as woodland. Some are used for pasture or wildlife habitat.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay or pasture, but it is suited if the stones and boulders are removed. Removal of the stones and boulders is difficult and costly. If the soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, terraces, diversions, cover crops, and contour stripcropping help to prevent excessive soil loss. Excess water is a problem, mainly in areas where the slope is less than 2 percent. The wetness is especially a problem in spring. The excess water can delay field preparation and planting. Land smoothing, surface drains, and diversions help to remove this water.

This soil is generally unsuited to permanent pasture and hayland, but it is suited if the stones and boulders are removed. Removal of the stones and boulders is difficult and costly. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Planting and harvesting by machine is limited by the stones and boulders and by wetness. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes

with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness, this soil is poorly suited to septic tank absorption fields. In some places this limitation can be overcome by constructing a filtering mound of suitable material. In other places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIs. The woodland ordination symbol is 3X.

## KaB—Kennan sandy loam, 2 to 8 percent slopes

This deep, undulating and rolling, well drained soil is on knolls and the tops of ridges on terminal and recessional moraines and on drumlins. Most areas are irregular in shape and range from about 10 to 120 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 4 inches thick. Below this is brown and dark brown sandy loam about 14 inches thick. The subsoil to a depth more than 60 inches is dark brown sandy loam. In some places the upper part of the soil is silt loam, loam, or loamy sand. In other places the slope is less than 2 or more than 8 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley soils in the lower landscape positions and small areas of the somewhat excessively drained Chetek and well drained Rosholt soils. Chetek and Rosholt soils are in landscape positions similar to those of the Kennan soil. They have more gravel in the lower part of the subsoil and in the substratum than does Kennan soils. Also included are areas of Kennan soils that have stones and boulders in the surface layer. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of Kennan soil and moderate or moderately rapid in the substratum. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer is moderate or moderately low.

Most areas of this soil are used as cropland. A few are used for pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a slight or moderate hazard. Also, soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, terraces, contour stripcropping, contour farming, and a cropping system that includes rotational hay and pasture help to prevent excessive water erosion. Wind stripcropping, cover crops, conservation tillage, and field windbreaks help to prevent excessive soil blowing. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of some harvesting or planting equipment may be limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is suited to septic tank absorption fields and to dwellings. Because of frost action, it is only moderately suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3L.

## KaC—Kennan sandy loam, 8 to 15 percent slopes

This deep, rolling and hilly, well drained soil is on knolls and on the sides and tops of ridges and hills on terminal and recessional moraines and on drumlins. Most areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The next layer is brown and dark brown sandy loam about 18 inches thick. The subsoil is dark brown sandy loam about 22 inches thick. The substratum to a depth of about 60 inches is brown loamy sand. In some places the upper part of the soil is silt loam, loam, or loamy sand. In other places the slope is less than 8 or more than 15 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley soils in the lower landscape positions and small areas of the somewhat excessively drained Chetek soils. Chetek soils are in landscape positions similar to those of the Kennan soil. They have more gravel in the lower part of the subsoil and in the substratum than does the Kennan soil. Also included are areas of Kennan soils that have stones and boulders in the surface layer. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Kennan soil and moderate or moderately rapid in the substratum. Surface runoff is medium. Available water capacity is moderate. The organic matter content in the surface layer is moderate or moderately low.

Most areas of this soil are used as cropland. A few are used for pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a moderate hazard. The complex slopes generally limit the erosion-control measures that can be used on this soil. Effective measures include a conservation tillage system, such as chisel planting, that leaves a protective amount of crop residue on the surface and a cropping system that includes rotational hay and pasture. Proper management of crop residue and green manure crops help to control water erosion, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of some harvesting or planting equipment can be limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the slope, this soil is only moderately suited to septic tank absorption fields. The slope can be reduced by cutting and filling, or a trench absorption system can be installed on the contour.

Because of the slope, this soil is only moderately suited to dwellings. The slope can be reduced by cutting and filling, or the dwellings can be designed so that they conform to the natural slope of the land.

This soil is only moderately suited to local roads and streets because of the slope and frost action. The slope can be reduced by cutting and filling to shape the roadway. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIe. The woodland ordination symbol is 3L.

## KaD2—Kennan sandy loam, 15 to 30 percent slopes, eroded

This deep, hilly or very hilly, well drained soil is on the sides of hills and ridges on terminal and recessional moraines and on drumlins. Most areas are irregular in shape or long and narrow and range from about 4 to 20 acres in size.

In many cultivated areas the original surface layer and subsurface layer have been removed by water erosion. Typically, the present surface layer is brown sandy loam about 7 inches thick. The next layer is dark brown and brown sandy loam about 8 inches thick. The subsoil is about 27 inches thick. It is dark brown. It is sandy loam in the upper part and loamy sand in the lower part. The substratum to a depth of about 60 inches is brown loamy sand. In some places the soil is not eroded and has a surface layer of dark brown silt loam, loam, or sandy loam and a subsurface layer of brown and dark brown silt loam, loam, or sandy loam. In other places the slope is less than 15 or more than 30 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek soils. These

soils are in landscape positions similar to those of the Kennan soil. They have more gravel in the lower part of the subsoil and in the substratum than does the Kennan soil. Also included are small areas of Kennan soils that are loamy sand in the upper part, that have stones and boulders in the surface layer, or in which the original surface layer, the subsurface layer, and the upper part of the subsoil have been removed by erosion. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Kennan soil and moderate or moderately rapid in the substratum. Surface runoff is rapid. Available water capacity is moderate. The organic matter content in the surface layer is low.

Most areas of this soil are used as cropland. A few are used for pasture or woodland.

Because of a severe hazard of water erosion, this soil generally is unsuited to row crops. The less sloping areas are suited to small grain and to grasses and legumes for rotational hay and pasture. Many areas are eroded. The complex slopes generally limit the erosion-control measures that can be used on this soil. Effective measures include a conservation tillage system, such as chisel planting, that leaves a protective amount of crop residue on the surface and a cropping system that includes rotational hay and pasture. Proper management of crop residue and green manure crops help to control water erosion, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Slope and plant competition are the main management concerns. Also, because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Planting the trees on the contour and carefully locating skid roads during harvest minimize erosion. Seedling survival on the steeper slopes facing south or west can be improved by carefully planting vigorous nursery stock. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of slope, this soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets. The slope can be reduced by cutting and filling. Also, a trench absorption system can be installed on the contour, dwellings can be designed so that they conform to the natural slope of the land, and roads can be constructed in the less sloping areas.

The land capability classification is VIe. The woodland ordination symbol is 3R.

## KeB—Kennan sandy loam, 2 to 8 percent slopes, bouldery

This deep, undulating and rolling, well drained soil is on knolls and the tops of ridges on terminal and recessional moraines and on drumlins. Many boulders and stones are in the surface layer. Most areas are irregular in shape and range from about 10 to 320 acres in size.

Typically, the surface layer is very dark brown sandy loam about 3 inches thick. The next layer is dark brown sandy loam about 5 inches thick. Below this is brown and dark brown sandy loam about 23 inches thick. The subsoil to a depth of more than 60 inches is dark brown sandy loam. In some places the upper part of the soil is silt loam, loam, or loamy sand. In other places the slope is more than 8 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley soils in the lower landscape positions and small areas of the somewhat excessively drained Chetek and well drained Rosholt soils. Chetek and Rosholt soils are in landscape positions similar to those of the Kennan soil. They have more gravel in the lower part of the subsoil and in the substratum than does the Kennan soil. Also included are areas of Kennan soils that have been cleared of stones and boulders or that naturally have few of these rock fragments. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Kennan soil and moderate or moderately rapid in the substratum. Available water capacity is moderate. The organic matter content in the surface layer is moderate or high.

Many areas of this soil are used as woodland. Some are used for pasture.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay and pasture, but it is suited if the stones and boulders are removed. Removal of these stones and boulders is difficult and costly. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, contour farming, and a cropping

system that includes rotational hay or pasture help to prevent excessive soil loss. Proper management of crop residue and green manure crops help to control water erosion, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is generally unsuited to permanent pasture and hayland, but it is suited if the stones and boulders are removed. Removal of these stones and boulders is difficult and costly. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the stones and boulders. Because of low soil strength, it also is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the large stones, this soil is only moderately suited to septic tank absorption fields and dwellings. The large stones and boulders can be removed by mechanical means.

This soil is moderately suited to local roads and streets because of frost action and the large stones. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. The large stones and boulders can be removed by mechanical means.

The land capability classification IIIs. The woodland ordination symbol is 3X.

## KeC—Kennan sandy loam, 8 to 15 percent slopes, bouldery

This deep, rolling and hilly, well drained soil is on knolls and on the sides and tops of ridges and hills on terminal and recessional moraines and on drumlins. Many boulders and stones are in the surface layer. Most areas are irregular in shape and range from about 10 to 640 acres in size.

Typically, the surface layer is black sandy loam about 3 inches thick. The next layer is dark brown sandy loam about 5 inches thick. Below this is brown and dark brown sandy loam about 23 inches thick. The subsoil is dark brown sandy loam about 25 inches thick. The substratum to a depth of about 60 inches is brown loamy sand. In some places the upper part of the soil is silt loam, loam, or loamy sand. In other places the slope is less than 8 or more than 15 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley soils in the lower landscape positions and small areas of the somewhat excessively drained Chetek and excessively drained Mahtomedi soils. Chetek and Mahtomedi soils are in landscape positions similar to those of the Kennan soil. They have more gravel in the lower part of the subsoil and in the substratum than does the Kennan soil. Mahtomedi soils are sandy throughout. Also included are areas of Kennan soils that have been cleared of the stones and boulders or that naturally have few of these rock fragments. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Kennan soil and moderate or moderately rapid in the substratum. Available water capacity is moderate. The organic matter content in the surface layer is moderate or high.

Most areas of this soil are used as woodland. A few are used for pasture.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay and pasture, but it is suited if the stones and boulders are removed. Removal of these stones and boulders is difficult and costly. If this soil is cultivated, water erosion is a moderate hazard. The complex slopes generally limit the erosion-control measures that can be used on this soil. Effective measures include a conservation tillage system, such as chisel planting, that leave a protective amount of crop residue on the surface and a cropping system that includes rotational hay and pasture. Proper management of crop residue and green manure crops help to control water erosion, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is generally unsuited to permanent pasture and hayland, but it is suited if the stones and boulders are removed. Removal of these stones and boulders is difficult and costly. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the stones and boulders. Because of low soil strength, it also is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the slope and the large stones, this soil is only moderately suited to septic tank absorption fields and to dwellings. The slope can be reduced by cutting and filling. Also, a trench absorption system can be installed on the contour, and dwellings can be designed so that they conform to the natural slope of the land. The large stones and boulders can be removed by mechanical means.

This soil is only moderately suited to local roads and streets because of the slope, frost action, and the large stones. The slope can be reduced by cutting and filling to shape the roadway, or the road can be built in the less sloping areas. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. The large stones and boulders can be removed by mechanical means.

The land capability classification is IVe. The woodland ordination symbol is 3X.

## KeE—Kennan sandy loam, 15 to 30 percent slopes, bouldery

This deep, hilly and very hilly, well drained soil is on the sides of hills and ridges on terminal and recessional moraines and on drumlins. Many boulders and stones are in the surface layer. Most areas are irregular in shape or long and narrow and range from about 10 to 240 acres in size.

Typically, the surface layer is very dark brown sandy loam about 3 inches thick. The next layer is dark brown cobbly sandy loam about 4 inches thick. The subsurface layer is brown sandy loam about 7 inches thick. Below this is brown and dark brown sandy loam about 19 inches thick. The subsoil is reddish brown and dark brown sandy loam about 25 inches thick. The substratum to a depth of about 60 inches is brown loamy sand. In some places the upper part of the soil is silt loam, loam, or loamy sand. In other places the slope is less than 15 or more than 30 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek soils and the excessively drained Mahtomedi soils. Both soils are in landscape positions similar to those of the Kennan soil. They have more gravel in the lower part of the subsoil and in the substratum than does the Kennan soil. Mahtomedi soils are sandy throughout. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Kennan soil and moderate or moderately rapid in the substratum. Available water capacity is moderate. The organic matter content in the surface layer is moderate or high.

Most areas of this soil are used as woodland. A few are used for pasture.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay and pasture because of the stones and boulders. Removal of these stones and boulders is difficult and costly. Where the stones and boulders are removed, the soil is generally unsuited to row crops because water erosion is a severe hazard. Cleared areas are suited to small grain and to grasses and legumes for rotational hay and pasture. Many cultivated areas are eroded. The complex slopes generally limit the erosion-control measures that can be used on this soil. Effective measures include a conservation tillage system, such as chisel planting, that leaves a protective amount of crop residue on the surface and a cropping system that includes rotational hay and pasture. Proper management of crop residue and green manure crops help to control water erosion, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is generally unsuited to permanent pasture and hayland, but it is suited if the stones and boulders are removed. Removal of these stones and boulders is difficult and costly. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Slope, the large stones and boulders, and plant competition are the main management concerns. Seedling survival on the steeper slopes facing south or west can be improved by carefully planting vigorous nursery stock. The use of some planting and harvesting equipment is limited by the slope and the stones and boulders. Because of low soil strength, it also is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the slope, this soil is poorly suited to septic tank absorption fields, to dwellings, and to local roads and streets. The slope can be reduced by cutting and filling. Also, a trench absorption system can be installed on the contour, dwellings can be

designed so that they conform to the natural slope of the land, and roads can be built in the less sloping areas.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

## LDF—Landfill

This map unit consists of areas where accumulated waste products of human habitation have been deposited. The areas can be above or below the ground.

No land capability classification has been assigned.

## LoB—Loyal silt loam, 1 to 6 percent slopes

This deep, nearly level and gently sloping, moderately well drained soil is on broad knolls and ridgetops on ground moraines. Most areas are irregular in shape and range from about 4 to 1,000 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown, mottled silt loam about 5 inches thick. The next layer is about 11 inches thick. It is mottled. It is brown silt loam in the upper part and reddish brown and brown loam in the lower part. The subsoil is reddish brown, mottled loam about 24 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled loam. In some places the substratum is loamy material weathered from igneous and metamorphic bedrock. In places in southwestern Spencer Township, sandstone bedrock is at a depth of less than 60 inches. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the well drained Fenwood and Rozellville soils and the somewhat poorly drained Rietbrock and Withee soils. Fenwood and Rozellville soils are in landscape positions similar to those of the Loyal soil. Rietbrock and Withee soils are in the lower concave positions. Rietbrock soils have bedrock at a depth of 40 to 60 inches. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the silty upper part of this Loyal soil and extremely slow to slow in the loamy till. Surface runoff is medium. Available water capacity is high. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal high water table is at a depth of 1.0 to 2.5 feet.

Most areas of this soil are used as cropland. A few are used as woodland or for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to prevent excessive soil loss, help to maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicide or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. Vegetation for food and cover can be planted or can naturally regenerate.

Because of wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of wetness, this soil is poorly suited to dwellings with basements. It is only moderately suited to dwellings without basements because of the wetness. The wetness can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet, or the site elevation can be raised by filling.

This soil is only moderately suited to local roads and streets because of wetness and frost action. The wetness can be overcome by using fill material to raise the roadbed above the level of wetness or by increasing the thickness of the subbase. The potential for frost action can be reduced by replacing the upper

part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3L.

## LoC—Loyal silt loam, 6 to 12 percent slopes

This deep, sloping, moderately well drained soil is on the tops and sides of knolls and ridges on ground moraines. Most areas are long and narrow or irregular in shape and range from about 4 to 120 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 5 inches thick. The next layer is about 10 inches thick. It is mottled. It is brown silt loam in the upper part and reddish brown and brown loam in the lower part. The subsoil is reddish brown, mottled loam about 21 inches thick. The substratum to a depth of about 60 inches is reddish brown, mottled loam. In some places the substratum is loamy material weathered from igneous and metamorphic bedrock. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Fenwood and Rozellville soils in landscape positions similar to those of the Loyal soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the silty upper part of this Loyal soil and extremely slow to slow in the loamy till. Surface runoff is medium. Available water capacity is high. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal high water table is at a depth of 1.0 to 2.5 feet.

Most areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to prevent excessive soil loss, help to maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicide or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of wetness, this soil is poorly suited to dwellings with basements. It is only moderately suited to dwellings without basements because of the wetness and the slope. The wetness can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet, or the site elevation can be raised by filling. The slope can be reduced by cutting and filling, or the dwellings can be designed so that they conform to the natural slope of the land.

This soil is only moderately suited to local roads and streets because of wetness, the slope, and frost action. The wetness can be overcome by using fill material to raise the roadbed above the level of wetness or by increasing the thickness of the subbase. The slope can be reduced by cutting and filling. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIe. The woodland ordination symbol is 3L.

## MaB—Magnor silt loam, 0 to 4 percent slopes

This deep, nearly level and gently sloping, somewhat poorly drained soil is in concave areas on broad ground moraines. Most areas are irregular in shape and range from about 20 to 2,500 acres in size.

Typically, the surface layer is very dark grayish

brown silt loam about 10 inches thick. The next layer is about 14 inches thick. It is mottled. It is pale brown and strong brown silt loam in the upper part and yellowish red and pinkish gray sandy loam in the lower part. The subsoil is yellowish red and reddish brown, mottled sandy loam about 26 inches thick. The substratum to a depth of about 60 inches is dark reddish brown gravelly sandy loam. In some places the subsoil and substratum are loam, sandy clay loam, or clay loam. In other places the upper part of the soil is loam or sandy loam. In some areas the slope is less than 1 or more than 6 percent.

Included with this soil in mapping are small areas of the poorly drained and very poorly drained Cable soils, the moderately well drained Freeon soils, and the well drained Amery soils. Cable soils are in drainageways and depressions. Amery and Freeon soils are on the convex tops and sides of knolls. Also included are areas of Magnor soils that have cobbles and stones in the surface layer, that have pockets or strata of gravel, sand, or loamy sand in the substratum, or that have bedrock at a depth of 40 to 60 inches. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the silty upper part of this Magnor soil and extremely slow to slow in the loamy subsoil and substratum. Surface runoff is medium or slow. Available water capacity is moderate. The organic matter content in the surface layer also is moderate. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight hazard. Cover crops and conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface help to prevent excessive soil loss. Excess water also is a problem. It limits the choice of crops or results in crop damage during most years. The wetness also delays field preparation, planting, or harvest. Land smoothing, surface drains, and diversions help to remove this water.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

This soil is poorly suited to local roads and streets because of the wetness and frost action. The wetness can be overcome by using fill material to raise the roadbed above the wetness level or lowering the seasonal water table by installing a subsurface drainage system. The potential for frost action can be overcome by installing a subsurface drainage system in the roadbed or by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3W.

## MbB—Mahtomedi loamy sand, 0 to 6 percent slopes

This deep, nearly level and gently sloping, excessively drained soil is on broad or narrow flats and knolls on stream terraces and outwash plains. Most areas are irregular in shape and range from about 10 to 800 acres in size.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsoil is about 16 inches thick. It is dark brown. It is loamy sand in the upper part and gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is light brown gravelly coarse sand. In some places the surface layer is sandy loam or gravelly loamy sand. In other places the subsoil and substratum are sand or have thin strata of loamy sand, loamy fine sand, or fine sandy loam. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of

the moderately well drained Mahtomedi soils in the slightly lower landscape positions. Also included are small areas of the somewhat excessively drained Chetek soils in landscape positions similar to those of the Mahtomedi soil. Chetek soils have more silt and clay in the upper part than does the Mahtomedi soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Mahtomedi soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is low or very low.

Most areas of this soil are used as cropland. Some areas have been planted to trees or developed as building sites.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It tends to be droughty during periods of low rainfall and is subject to soil blowing. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, and field windbreaks help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling soil blowing. Proper management of crop residue and green manure crops help to prevent excessive soil loss, increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. The traction of some equipment used for planting and harvesting is limited when the upper part of the soil is dry.

This soil is suited to the development of openland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is suited to dwellings and to local roads and streets. It can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 6S.

## MbC—Mahtomedi loamy sand, 6 to 15 percent slopes

This deep, sloping and moderately steep, excessively drained soil is on the sides of ridges and knolls on stream terraces and outwash plains. Most areas are long and narrow or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is dark brown loamy sand about 6 inches thick. The subsoil is about 17 inches thick. It is dark brown loamy sand in the upper part and strong brown gravelly loamy coarse sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown gravelly coarse sand. In some places the surface layer is sandy loam or gravelly loamy sand. In other places the subsoil and substratum are sand or have thin strata of loamy sand, loamy fine sand, or fine sandy loam. In some areas the slope is less than 6 or more than 15 percent.

Included with this soil in mapping are small areas of the moderately well drained Mahtomedi soils in the lower landscape positions. Also included are small areas of the somewhat excessively drained Chetek soils in landscape positions similar to those of the Mahtomedi soil. Chetek soils have more silt and clay in the upper part than does the Mahtomedi soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Mahtomedi soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is low or very low.

Some areas of this soil are used as cropland. Some have been planted to trees or are used for pasture.

This soil is poorly suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It tends to be droughty during periods of low rainfall and is subject to soil blowing. Where an adequate water supply is available, irrigation can supplement rainfall. Because of the slope, however, some types of irrigation equipment do not function properly. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, and field windbreaks help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling soil blowing. Proper management of crop residue and green manure crops help to prevent excessive soil loss, increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. The traction of some equipment used for planting and harvesting is limited when the upper part of the soil is dry.

This soil is suited to the development of openland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

Because of slope, this soil is only moderately suited to dwellings and to local roads and streets. The slope can be reduced by cutting and filling. Also, dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is IVs. The woodland ordination symbol is 6S.

## MbE—Mahtomedi loamy sand, 15 to 45 percent slopes

This deep, moderately steep to very steep, excessively drained soil is on escarpments and on the sides of hills and ridges on stream terraces and outwash plains. Most areas are long and narrow and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark brown loamy sand about 3 inches thick. The subsoil is about 13 inches thick. It is dark brown. It is loamy sand in the upper part and gravelly loamy coarse sand in the lower part. The next layer is strong brown gravelly coarse sand about 5 inches thick. The substratum to a depth of about 60 inches is light yellowish brown gravelly coarse sand. In some places the surface layer is sandy loam or gravelly loamy sand. In other places the subsoil and substratum are sand or have thin strata of fine sand, loamy fine sand, or fine sandy loam. In some areas the slope is less than 15 or more than 45 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek soils. These soils are in landscape positions similar to those of the Mahtomedi soil. They have more silt and clay in the upper part than does the Mahtomedi soil. Also included are areas where erosion has removed the upper part of the Mahtomedi soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Mahtomedi soil. Available water capacity is low. The organic matter content in the surface layer is very low or low.

Most areas are used as woodland or unimproved pasture.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay and pasture because of the low available water capacity, the slope, and the hazards of water erosion and soil blowing. Maintaining a permanent cover of vegetation is the best way to control soil loss.

Permanently vegetated areas can be used for pasture. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. The use of some planting and harvesting equipment can be limited by the slope and by poor traction when the upper part of the soil is dry. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion.

This soil is poorly suited to the development of wildlife habitat. Because of excessive soil drainage and the slope, establishing the vegetation that provides food and cover is difficult.

Because of the slope, this soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets. This limitation can be overcome by cutting and filling. Also, a trench absorption system can be installed on the contour in places. Although the soil can readily absorb the effluent in septic tank absorption fields, it does not adequately filter it. The poor filtering capacity can result in the pollution of ground water. Dwellings can be designed so that they conform to the natural slope of the land, and roads can be constructed in the less sloping areas.

The land capability classification is VIIs. The woodland ordination symbol is 6R.

## McA—Mahtomedi loamy sand, moderately well drained, 0 to 3 percent slopes

This deep, nearly level and gently sloping, moderately well drained soil is on broad or narrow flats adjacent to lower depressional areas on stream terraces and outwash plains. Most areas are irregular in shape and range from about 4 to 480 acres in size.

Typically, the surface layer is very dark grayish

brown loamy sand about 7 inches thick. The subsoil is about 12 inches thick. It is dark yellowish brown loamy sand in the upper part and dark brown gravelly loamy coarse sand in the lower part. The next layer is dark brown gravelly coarse sand about 7 inches thick. The substratum to a depth of about 60 inches is gravelly sand. It is strong brown in the upper part and light yellowish brown and mottled in the lower part. In some places the surface layer is sandy loam. In other places the subsoil and substratum are sand or have thin strata of loamy sand, loamy fine sand, or fine sandy loam.

Included with this soil in mapping are small areas of the excessively drained Mahtomedi and somewhat excessively drained Chetek soils in the higher landscape positions and the somewhat poorly drained Meehan and Oesterle soils in the lower positions. Also included are small areas of Scott Lake soils in landscape positions similar to those of the Mahtomedi soil. Scott Lake soils have more silt and clay in the upper part than does the Mahtomedi soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Mahtomedi soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is low or very low. During wet periods a seasonal high water table is at a depth of 2.5 to 6.0 feet.

Many areas of this soil are used as cropland. Some have been planted to trees or are used for pasture.

This soil is poorly suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It tends to be droughty during periods of low rainfall and is subject to soil blowing. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, and field windbreaks help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling soil blowing. Proper management of crop residue and green manure crops help to prevent excessive soil loss, increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The traction of some equipment used for planting and harvesting is limited when the upper part of the soil is dry.

This soil is suited to the development of openland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb the effluent but does not adequate filter it. The poor filtering capacity can result in the pollution of ground water. In some areas both of the limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is only moderately suited to dwellings with basements. It is suited to dwellings without basements. The basement can be constructed above the level of wetness.

This soil is suited to local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 6S.

## MdB—Marathon silt loam, 2 to 6 percent slopes

This deep, gently sloping, well drained soil is on broad knolls and ridgetops in the uplands. Most areas are irregular in shape and range from about 4 to 320 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is brown, dark yellowish brown, and dark brown silt loam about 19 inches thick. The subsoil is about 28 inches thick. It is brown and dark brown very gravelly coarse sandy loam in the upper part and dark brown, strong brown, and yellowish red extremely gravelly loamy coarse sand in the lower part. The substratum to a depth of about 60 inches is strong brown extremely gravelly loamy coarse sand. In some places the substratum is very gravelly or extremely gravelly sandy loam. In other places the slope is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Mylrea soils in the lower landscape positions and small areas of Fenwood, Moberg, Mosinee, and Rozellville soils. These soils are in landscape positions similar to those of the Marathon soil. Fenwood and Mosinee soils have bedrock at a depth of 40 to 60 inches. Moberg soils are somewhat excessively drained and have thinner silty deposits and more gravel in the upper part than does the Marathon soil. Rozellville soils have more clay in the subsoil and less gravel in the subsoil and substratum

than does the Marathon soil. Also included are small areas of Marathon soils that have bedrock within a depth of 60 inches, that have cobbles and stones in the surface layer, or that have a seasonal high water table at a depth of 3 to 5 feet. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Marathon soil and rapid in the substratum. Surface runoff is medium. Available water capacity is moderate. The organic matter content in the surface layer also is moderate.

Many areas are used as cropland. Some are used for pasture, for woodland, or as a source of roadfill commonly known as rotten granite.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is suited to septic tank absorption fields and to dwellings. Because of frost action, it is only moderately suited to local roads and streets. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3L.

## MdC—Marathon silt loam, 6 to 12 percent slopes

This deep, sloping, well drained soil is on the sides of knolls and ridges in the uplands. Most areas are long and narrow or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The next layer is brown and dark brown silt loam about 15 inches thick. The subsoil is about 27 inches thick. It is dark brown very gravelly coarse sandy loam in the upper part and strong brown extremely gravelly loamy coarse sand in the lower part. The substratum to a depth of about 60 inches is strong brown extremely gravelly loamy coarse sand. In some places the substratum is very gravelly or extremely gravelly sandy loam. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of Fenwood, Moberg, and Mosinee soils. These soils are in landscape positions similar to those of the Marathon soil. Fenwood and Mosinee soils have bedrock at a depth of 40 to 60 inches. Moberg soils are somewhat excessively drained. They have thinner silty deposits and have more gravel in the upper part than does the Marathon soil. Also included are small areas of Marathon soils that have bedrock at a depth of less than 60 inches or that have cobbles and stones in the surface layer. Included soils make up 10 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Marathon soil and rapid in the substratum. Surface runoff is medium. Available water capacity is moderate. The organic matter content in the surface layer also is moderate.

Some areas of this soil are used as cropland. Some are used for pasture or woodland or as a source of roadfill commonly known as rotten granite.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of slope, this soil is only moderately suited to septic tank absorption fields. The slope can be reduced by cutting and filling, or trench absorption systems can be installed on the contour.

Because of the slope, this soil is only moderately suited to dwellings. The slope can be reduced by cutting and filling, or the dwellings can be designed so that they conform to the natural slope of the land.

This soil is only moderately suited to local roads and streets because of the slope and frost action. The slope can be reduced by cutting and filling to shape the roadway. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIe. The woodland ordination symbol is 3L.

## MeC—Marathon silt loam, 2 to 15 percent slopes, stony

This deep, gently sloping to moderately steep, well drained soil is on the tops and sides of knolls and ridges on uplands. Many cobbles, stones, and boulders are in the surface layer. Most areas are long and narrow or irregular in shape and range from about 4 to 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The next layer is dark yellowish brown silt loam about 8 inches thick. Below that is dark brown and pale brown silt loam about 6 inches thick. The subsoil is about 23 inches thick. It is dark brown. It is very gravelly coarse sandy loam in the upper part and extremely gravelly loamy coarse sand in the lower part. The substratum to a depth of about 60 inches is strong brown extremely gravelly loamy coarse sand. In some places the upper part of the soil is gravelly silt loam or gravelly loam. In other places the slope is more than 15 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Mylrea soils in the lower landscape positions. Also included are small areas of Fenwood and Mosinee soils in landscape positions similar to those of the Marathon soil; small areas of Marathon soils that have bedrock at a depth of less than 60 inches, that do not have cobbles, stones, and boulders in the surface layer, or that have a seasonal high water table at a depth of 3 to 5 feet; and areas of rock outcrops. Fenwood and Mosinee soils have bedrock at a depth of 40 to 60 inches. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Marathon soil and rapid in the substratum. Available water capacity is moderate. The organic matter content is moderate or high in the surface layer.

Most areas of this soil are used as woodland. A few are used for pasture or as a source of roadfill commonly known as rotten granite.

This soil is generally unsuited to cultivated crops, hay, and pasture because of the many stones and boulders.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the stones and boulders. Because of low soil strength, it also is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of slope, this soil is only moderately suited to septic tank absorption fields. The slope can be reduced by cutting and filling, or a trench absorption system can be installed on the contour.

Because of the slope, this soil is only moderately suited to dwellings. The slope can be reduced by cutting and filling, or the dwellings can be designed so that they conform to the natural slope of the land.

This soil is only moderately suited to local roads and streets because of the slope and frost action. The slope can be reduced by cutting and filling to shape the roadway, or the road can be built in the less sloping areas. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IVe. The woodland ordination symbol is 3X.

## MfA—Marshfield silt loam, 0 to 3 percent slopes

This deep, nearly level and gently sloping, poorly drained soil is in depressions and drainageways on ground moraines. It is subject to ponding. Most areas are long and narrow or irregular in shape and range from about 10 to 480 acres in size.

Typically, the surface layer is very dark brown, mottled silt loam about 8 inches thick. The subsurface layer is grayish brown, mottled silt loam about 8 inches thick. The subsoil is light brownish gray, mottled silt loam and loam about 18 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, mottled sandy loam. In some places the subsoil is sandy loam. In other places the substratum is gravelly loam, gravelly clay loam, gravelly sandy loam, or gravelly loamy sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Withee soils in the higher landscape positions and small areas of the very poorly drained Cathro soils in the lower positions in the drainageways and depressions. The upper part of the Cathro soils is muck. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderately slow or moderate in this Marshfield soil. Surface runoff is very slow or ponded. Available water capacity is high. The organic matter content in the surface layer is moderate to very high. During wet periods a seasonal high water table is within a depth of 1 foot.

Many areas of this soil are used as cropland. Some are used as woodland or pasture.

Undrained areas are generally unsuitable as cropland because of wetness. If drained, this soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Land smoothing and surface drains help to remove excess water. Many areas are in intermittent drainageways and should be used as grassed waterways.

Drained areas are suited to permanent pasture and hayland. Proper stocking rates, rotational grazing, pasture renovation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the ponding and the moderately slow permeability, this soil is generally unsuited to septic tank absorption fields. Because of the ponding, it is generally unsuited to dwellings. Overcoming these limitations is difficult.

This soil is poorly suited to local roads and streets because of low soil strength, ponding, and frost action. The ponding can be overcome by removing the surface water through culverts and ditches or by adding fill material to raise the road above the ponding level. Culverts also help to prevent road damage by equalizing the water level on each side of the road. Low strength and frost action can be overcome by excavating the upper part of the soil and replacing it with coarse textured base material, such as sand or gravel.

The land capacity classification is IIIw in drained areas and VIw in undrained areas. The woodland ordination symbol is 3W.

## MgA—Meadland loam, 0 to 3 percent slopes

This deep, nearly level and gently sloping, somewhat poorly drained soil is in slightly convex and concave areas on broad ground moraines. Most areas are long and narrow or irregular in shape and range from about 10 to 640 acres in size.

Typically, the surface layer is very dark brown loam about 2 inches thick. The next layer is dark brown loam about 5 inches thick. Below this is brown and dark yellowish brown, mottled loam about 18 inches thick. The subsoil is dark yellowish brown, mottled loam about 16 inches thick. The substratum to a depth of about 60 inches is multicolored gravelly loam. In some places the upper part of the soil is silt loam or sandy loam. In other places the subsoil and substratum are clay loam or clay.

Included with this soil in mapping are small areas of the well drained Mosinee soils, the moderately well drained Guenther soils, and the poorly drained Dancy and Sherry soils. Guenther and Mosinee soils are in the higher landscape positions. Dancy and Sherry soils are in depressions and drainageways. Also included are small areas of Rockers soils in landscape positions similar to those of the Meadland soil and

small areas of Meadland soils that have cobbles and stones in the surface layer or that have bedrock within a depth of 60 inches. Rockers soils are loamy sand in the upper part. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately slow in this Meadland soil. Surface runoff is slow. Available water capacity is high. The organic matter content in the surface layer is moderate or moderately low. During wet periods a seasonal high water table is at a depth of 1.0 to 2.5 feet.

Some areas of this soil are used as cropland. Others are used for pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Unless the soil is adequately drained, excess water limits the choice of crops or results in crop damage in most years. It also delays field preparation, planting, or harvest. Land smoothing, surface drains, and diversions help to remove this water.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, or constructing basements above the level of wetness helps to overcome this limitation. The limitation also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIw. The woodland ordination symbol is 5W.

## MhA—Meadland loam, 0 to 3 percent slopes, stony

This deep, nearly level and gently sloping, somewhat poorly drained soil is in slightly convex and concave areas on broad ground moraines. Many cobbles and stones are in the surface layer. Most areas are irregular in shape and range from about 4 to 1,280 acres in size.

Typically, the surface layer is very dark gray loam about 3 inches thick. The subsurface layer is dark grayish brown loam about 2 inches thick. The next layer is dark brown, mottled sandy loam about 4 inches thick. Below this is about 6 inches of dark brown and brown, mottled loam and sandy loam. The subsoil is dark brown, mottled loam about 10 inches thick. The substratum to a depth of about 60 inches is brown, mottled loam. In some places the upper part of the soil is silt loam, sandy loam, or loamy sand. In other places the subsoil and substratum are clay loam or clay.

Included with this soil in mapping are small areas of the well drained Mosinee soils, the moderately well drained Guenther soils, and the poorly drained Dancy soils. Guenther and Mosinee soils are in the higher landscape positions. Dancy soils are in drainageways and depressions. Also included are small areas of Meadland soils that have bedrock within a depth of 60 inches or have rock outcrops. These outcrops are mostly igneous and metamorphic rock but are sandstone in some areas in the southeastern part of Guenther Township. Inclusions make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately slow in this Meadland soil. Available water capacity is high. The organic matter content in the surface layer is moderate or high. During wet periods a seasonal high water table is at a depth of 1.0 to 2.5 feet.

Many areas of this soil are used as woodland. A few are used for pasture or wildlife habitat.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay and pasture because of wetness and the many stones.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the stones and wetness. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of

the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, or constructing basements above the level of wetness helps to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIIs. The woodland ordination symbol is 5X.

## Mm—Meehan loamy sand, 0 to 2 percent slopes

This deep, nearly level, somewhat poorly drained soil is on flats around depressions and along drainageways on outwash plains, stream terraces, and glacial lake plains. Most areas are long and narrow or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsoil is about 12 inches thick. It is dark brown loamy sand in the upper part and strong brown, mottled loamy sand in the lower part. The next layer is strong brown, mottled sand about 8 inches thick. The substratum to a depth of about 60 inches is grayish brown, mottled sand. In some places the surface layer is sandy loam. In other places the subsoil and substratum are gravelly sand.

Included with this soil in mapping are small areas of the moderately well drained Mahtomedi soils and the poorly drained and very poorly drained Newson soils. Mahtomedi soils are in the slightly higher landscape positions. Newson soils are in the depressions and drainageways. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Meehan soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is low to moderate. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Some areas of this soil are used as woodland. Some are used as cropland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Unless the soil is adequately drained, excess water limits the choice of crops or results in crop damage most years. It also delays field preparation, planting, or harvest. Controlled open ditch or tile drainage can lower the water table. When drained and cultivated, however, this soil is subject to soil blowing. Also, crop yields are limited by the low available water capacity. Irrigation can supplement rainfall. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, cover crops, wind stripcropping, and field windbreaks help to prevent excessive soil loss. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. In some areas both of the limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, or

constructing basements above the level of wetness helps to overcome this limitation. Otherwise, the wetness can be reduced by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

This soil is only moderately suited to local roads and streets because of the wetness and frost action. Fill material can be used to raise the road above the level of wetness. The potential for frost action can be reduced by adding fill material, such as sand or gravel, or by installing a good subsurface drainage system.

The land capability classification is IVw. The woodland ordination symbol is 5W.

## Mn—Minocqua sandy loam, 0 to 2 percent slopes

This deep, nearly level, poorly drained and very poorly drained soil is in drainageways and depressions on outwash plains. It is subject to ponding. Most areas are long and narrow or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark brown sandy loam about 5 inches thick. The subsoil is gray and grayish brown, mottled sandy loam about 14 inches thick. The next layer is dark grayish brown, mottled gravelly loamy sand about 4 inches thick. The substratum to a depth of about 60 inches is grayish brown gravelly sand. In some places the surface layer is muck, mucky silt loam, mucky loam, or mucky sandy loam. In other places the upper part of the soil is silt loam or loam. In some areas the substratum is stratified with loam, silt loam, sandy loam, loamy fine sand, fine sand, loamy sand, or sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Oesterle soils in the slightly higher landscape positions. Also included are small areas of Newson soils in landscape positions similar to those of the Minocqua soil and areas of Minocqua soils that have cobbles and stones in the surface layer. Newson soils have more sand and less silt and clay in the upper part than does the Minocqua soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the upper part of this Minocqua soil and rapid in the substratum. Surface runoff is very slow or ponded. Available water capacity is low. The organic matter content in the surface layer is high or very high. During wet periods a seasonal high water table is within a depth of 1 foot.

Many areas of this soil are used as woodland. Some are used for unimproved pasture or wetland wildlife habitat. A few areas have been drained and are used as cropland.

Undrained areas are generally unsuitable as cropland because of wetness and because of frost late in spring and early in fall. If drained, this soil is suited to oats and to clover and timothy for rotational hay and pasture. It is generally unsuited to corn because of the hazard of freezing. If drained, it is subject to soil blowing. Cover crops, conservation tillage, wind stripcropping, and a cropping system that includes rotational hay and pasture help to prevent excessive soil loss.

Drained areas are suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the ponding, this soil is generally unsuited to septic tank absorption fields and to dwellings. Overcoming this hazard is difficult.

This soil is poorly suited to local roads because of the ponding and frost action. The ponding can be overcome by removing the surface water through culverts and ditches or by adding fill material to raise the roads above the ponding level. Culverts also help to prevent road damage by equalizing the water level on each side of the road. The potential for frost action can be reduced by excavating the upper part of the soil and replacing it with coarse textured base material, such as sand or gravel.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 7W.

## MoB—Moberg gravelly silt loam, 2 to 6 percent slopes

This deep, undulating, somewhat excessively drained soil is on knolls and ridgetops in the uplands. Most areas are irregular in shape and range from about 4 to 240 acres in size.

Typically, the surface layer is dark brown gravelly silt loam about 5 inches thick. The subsoil is dark yellowish brown gravelly silt loam about 8 inches thick.

The next layer is dark brown very gravelly sandy loam about 13 inches thick. The substratum to a depth of about 60 inches is yellowish red extremely gravelly loamy coarse sand. In some places the upper part of the soil is silt loam, gravelly loam, or gravelly sandy loam. In other places the slope is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Mylrea soils in the lower landscape positions. Also included are small areas of the well drained Marathon and Mosinee soils in landscape positions similar to those of the Moberg soil, small areas of Moberg soils that have cobbles and stones in the surface layer, and areas of soils that have a seasonal high water table at a depth of 3 to 5 feet. Marathon soils have thicker silty deposits and have more clay in the subsoil than does the Moberg soil. Mosinee soils have bedrock at a depth of 40 to 60 inches. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Moberg soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderate or high.

Many areas of this soil are used as woodland. Some are used as cropland. Some are used as a source of roadfill commonly known as rotten granite.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. The soil tends to be droughty during periods of low rainfall. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Planting vigorous nursery stock helps to overcome seedling mortality.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is suited to dwellings and to local roads and streets. It can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIe. The woodland ordination symbol is 3F.

## MoC—Moberg gravelly silt loam, 6 to 15 percent slopes

This deep, rolling and hilly, somewhat excessively drained soil is on the sides and tops of ridges and knolls on uplands. Most areas are irregular in shape and range from about 4 to 320 acres in size.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 4 inches thick. The subsoil is dark brown gravelly silt loam about 8 inches thick. The next layer is strong brown very gravelly coarse sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is strong brown extremely gravelly loamy coarse sand. In some places the upper part of the soil is silt loam, gravelly loam, or gravelly sandy loam. In other places the original surface layer has been removed by water erosion. In some areas the slope is less than 6 or more than 15 percent.

Included with this soil in mapping are small areas of the well drained Marathon and Mosinee soils. These soils are in landscape positions similar to those of the Moberg soil. Marathon soils have thicker silty deposits and have more clay in the subsoil than does the Moberg soil. Mosinee soils have bedrock at a depth of 40 to 60 inches. Also included are small areas of Moberg soils in which the surface layer has cobbles and stones or in which the original surface layer and subsoil have been removed by water erosion. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Moberg soil. Surface runoff is medium. Available water capacity is low. The organic matter content in the surface layer is moderate or high.

Many areas are used as woodland. Some are used as cropland. Some are used as a source of roadfill commonly known as rotten granite.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a moderate hazard. The complex slopes generally limit the erosion-control measures used on this soil. Effective measures include a conservation tillage system, such as chisel planting, that leaves a protective amount of crop residue on the surface and a cropping system that includes rotational hay and

pasture. The soil tends to be droughty during periods of low rainfall. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Planting vigorous nursery stock helps to overcome seedling mortality.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, this soil is only moderately suited to dwellings and to local roads and streets. The slope can be reduced by cutting and filling. Also, dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is IVe. The woodland ordination symbol is 3F.

## MsB—Mosinee sandy loam, 2 to 6 percent slopes

This deep, gently sloping, well drained soil is on knolls and ridgetops in the uplands. Most areas are irregular in shape and range from about 4 to 200 acres in size.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 35 inches thick. It is dark yellowish brown gravelly sandy loam in the upper part, yellowish brown gravelly and very gravelly sandy loam in the next part, and yellowish brown extremely gravelly sandy loam in the lower part. Fractured igneous and metamorphic bedrock is at a depth of about 42 inches. The depth to hard bedrock ranges from 40 to 60 inches. In some places the upper part of the soil is loamy sand, loam, or silt loam. In other places the slope is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Meadland and Rietbrock soils in the lower landscape positions and small areas of the Fenwood, Guenther, and Moberg soils. Fenwood, Guenther, and Moberg soils are in landscape positions similar to those of the Mosinee soil. Fenwood soils have more silt in the surface layer and more clay in the subsoil than does the Mosinee soil. Guenther and Moberg soils do not have bedrock within a depth of 60 inches. Guenther soils are moderately well drained and are loamy sand in the surface layer and in the upper part of the subsoil. Moberg soils are somewhat excessively drained and are underlain by extremely gravelly loamy coarse sand. Also included are small areas of Mosinee soils that have bedrock at a depth more than 60 inches, that have a seasonal high water table at a depth of 3 to 5 feet, or that have cobbles and stones in the surface layer and areas of soils that have bedrock within a depth of 40 inches. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in this Mosinee soil. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderate.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a moderate hazard. Also, yields are affected by the low available water capacity during most years. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. Construction of terraces and diversions is limited by the gravelly and cobbly subsoil and the bedrock. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, increase the rate of water infiltration, and conserve moisture.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The use of site preparation and planting equipment may be limited by the gravel and cobbles in the subsoil. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the depth to bedrock and seepage of

effluent into fractures and cracks in the bedrock, this soil is only moderately suited to septic tank absorption fields. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of large stones and the depth to bedrock, this soil is only moderately suited to dwellings. The depth to bedrock can be overcome by ripping and excavating the bedrock with suitable power equipment, by adding fill material to raise the site, or by constructing the dwellings without basements or with only partially exposed basements. The larger stones can be removed by mechanical means.

This soil is only moderately suited to local roads and streets because of frost action and the large stones. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. Additions of suitable fill material can raise the roadbed a sufficient distance above the large stones.

The land capability classification is IIIe. The woodland ordination symbol is 4F.

## MsC—Mosinee sandy loam, 6 to 12 percent slopes

This deep, sloping, well drained soil is on the sides of knolls and ridges on uplands. Most areas are irregular in shape and range from about 4 to 160 acres in size.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 29 inches thick. It is dark yellowish brown and dark brown gravelly sandy loam in the upper part and yellowish brown very gravelly sandy loam in the lower part. The next layer is yellowish brown very cobbly sandy loam about 6 inches thick. Fractured igneous and metamorphic bedrock is at a depth of about 42 inches. The depth to hard bedrock ranges from 40 to 60 inches. In some places the upper part of the soil is loamy sand, loam, or silt loam. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Meadland and Rietbrock soils in the lower landscape positions. Also included are small areas of Fenwood and Moberg soils in landscape positions similar to those of the Mosinee soil, small areas of Mosinee soils that have bedrock at a depth of more than 60 inches or that have cobbles and stones in the surface layer, and areas of soils that have bedrock within a depth of 40 inches. Fenwood soils have more silt in the surface layer and more clay in the subsoil than does the Mosinee soil. Moberg soils are somewhat excessively drained, are underlain by extremely gravelly loamy coarse sand, and do not have bedrock within a depth of 60 inches. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in this Mosinee soil. Surface runoff is medium. Available water capacity is low. The organic matter content in the surface layer is moderate.

Some areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a moderate hazard. Also, yields are affected by the low available water capacity during most years. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour farming, contour stripcropping, terraces, and diversions help to prevent excessive soil loss. Construction of terraces and diversions is limited by the gravelly and cobbly subsoil and the bedrock. A cropping system that includes rotational hay and pasture also is effective in controlling water erosion. Proper management of crop residue and green manure crops help to reduce soil loss, maintain or increase organic matter content, increase the rate of water infiltration, and conserve moisture.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The use of site preparation and planting equipment may be limited by the gravel and cobbles in the subsoil. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the depth to bedrock, seepage of effluent into fractures and cracks in the bedrock, and the slope, this soil is only moderately suited to septic tank absorption fields. The depth to bedrock and seepage can be overcome by constructing a mound of suitable filtering material. Reducing the slope is difficult because cutting and filling can expose the bedrock. Selection of a less sloping area should be considered.

Because of the depth to bedrock, the large stones, and the slope, this soil is only moderately suited to dwellings. The depth to bedrock can be overcome by ripping and excavating the bedrock with suitable power equipment, by adding fill material to raise the site, or by constructing the dwellings without basements or

with only partially exposed basements. The excessively large stones that interfere with construction can be removed by mechanical means. Reducing the slope is difficult because cutting and filling can expose the bedrock. The dwellings can be designed so that they conform to the natural slope of the land, or a less sloping site can be selected.

This soil is only moderately suited to local roads and streets because of the slope, the potential for frost action, and the large stones. The slope can be reduced by cutting and filling. The cutting can expose the bedrock, which can be removed by blasting or by using a jackhammer or other suitable power equipment. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. The large stones can be removed by mechanical means. Otherwise, additions of suitable fill material can raise the roadbed a sufficient distance above the stones.

The land capability classification is IVe. The woodland ordination symbol is 4F.

## MsD—Mosinee sandy loam, 12 to 20 percent slopes

This deep, moderately steep, well drained soil is on the sides of hills and ridges on uplands. Most areas are long and narrow and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is dark brown and dark yellowish brown gravelly sandy loam in the upper part and dark brown very gravelly sandy loam in the lower part. The next layer is strong brown very cobbly sandy loam about 14 inches thick. Fractured igneous and metamorphic bedrock is at a depth of about 40 inches. The depth to bedrock ranges from 40 to 60 inches. In some places the upper part of the soil is loamy sand, loam, or silt loam. In other places the slope is less than 12 or more than 20 percent.

Included with this soil in mapping are small areas of Fenwood and Moberg soils. These soils are in landscape positions similar to those of the Mosinee soil. Fenwood soils have more silt in the surface layer and more clay in the subsoil than does the Mosinee soil. Moberg soils are somewhat excessively drained, are underlain by extremely gravelly loamy coarse sand, and do not have bedrock within a depth of 60 inches. Also included are small areas of Mosinee soils in which the original surface layer and the upper part of the subsoil have been removed by water erosion or in which the surface layer has cobbles and stones and areas of soils that have bedrock within a depth of 40 inches. Included soils make up about 10 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in this Mosinee soil. Surface runoff is rapid. Available water capacity is low. The organic matter content in the surface layer is moderate.

Many areas are used as woodland. A few are used as cropland or pasture.

Because water erosion is a severe hazard, this soil is generally unsuited to corn and small grain. It is suited to a cropping system of grasses and legumes for hay and pasture grown in rotation with cultivated crops. During most years, however, yields are affected by the low available water capacity.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help keep the pasture in good condition.

This soil is suited to trees. Slope and plant competition are the main management concerns. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion. Seedling survival on the steeper slopes facing south or west can be improved by carefully planting vigorous nursery stock. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of slope, this soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets. Overcoming this limitation is difficult because any excavation of the soil exposes the underlying bedrock.

The land capability classification is VIe. The woodland ordination symbol is 4R.

## MtC—Mosinee sandy loam, 2 to 15 percent slopes, stony

This deep, gently sloping to moderately steep, well drained soil is on the tops and sides of knolls and ridges on uplands. Many cobbles and stones are in the surface layer. Most areas are irregular in shape and range from about 4 to 320 acres in size.

Typically, the surface layer is very dark brown sandy loam about 3 inches thick. The subsurface layer is grayish brown sandy loam about 4 inches thick. The subsoil is about 34 inches thick. It is dark brown gravelly sandy loam in the upper part, dark yellowish brown very gravelly sandy loam in the next part, and

yellowish brown extremely gravelly sandy loam in the lower part. Fractured igneous and metamorphic bedrock is at a depth of about 42 inches. The depth to hard bedrock ranges from 40 to 60 inches. In places the upper part of the soil is loamy sand, loam, or silt loam. In some areas in the southeastern part of Guenther Township, the bedrock is sandstone. In some areas the slope is more than 15 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Rietbrock and Meadland soils in the lower landscape positions and small areas of the Fenwood, Guenther, and Moberg soils. These soils are in landscape positions similar to those of the Mosinee soil. Fenwood soils have more silt in the surface layer and more clay in the subsoil than does the Mosinee soil. Guenther soils are moderately well drained, are loamy sand in the surface layer and in the upper part of the subsoil, and do not have bedrock within a depth of 60 inches. Moberg soils are somewhat excessively drained, are underlain by extremely gravelly loamy coarse sand, and have bedrock at a depth of more than 60 inches. Also included are small areas of Mosinee soils that have bedrock at a depth of more than 60 inches, that have a seasonal high water table at a depth of 3 to 5 feet, or do not have cobbles and stones in the surface layer; areas of soils that have bedrock within a depth of 40 inches; and areas of bedrock outcrop. Inclusions make up 10 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in this Mosinee soil. Available water capacity is low. The organic matter content in the surface layer is moderate or high.

Most areas of this soil are used as woodland. A few are used for pasture. In some of the pastured areas, the surface stones have been removed.

This soil is generally unsuited to cultivated crops, hay, and pasture because of the many surface stones and the rock outcrops.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the stones and the rock outcrops. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the depth to bedrock, seepage of effluent into fractures and cracks in the bedrock, and the slope, this soil is only moderately suited to septic tank absorption fields. The depth to bedrock and the seepage can be overcome by constructing a mound of suitable filtering material. Reducing the slope is difficult because cutting and filling can expose the bedrock.

Because of the depth to bedrock, large stones, and the slope, this soil is only moderately suited to dwellings. The depth to bedrock can be overcome by ripping and excavating the bedrock with suitable power equipment, by adding fill material to raise the site, or by constructing the dwellings without basements or with only partially exposed basements. The large stones that interfere with construction can be removed by mechanical means. Reducing the slope is difficult because cutting and filling can expose the bedrock. The dwellings can be designed so that they conform to the natural slope of the land, or less sloping sites can be selected.

This soil is only moderately suited to local roads and streets because of the slope, the potential for frost action, and the large stones. The slope can be reduced by cutting and filling. The cutting and filling can expose the bedrock, which can be removed by blasting or by using a jackhammer or other suitable power equipment. The potential for frost action can be reduced by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. The large stones can be removed by mechanical means. Otherwise, additions of suitable fill material can raise the roadbed a sufficient distance above the stones.

The land capability classification is VIe. The woodland ordination symbol is 4X.

## MyB—Mylrea silt loam, 1 to 6 percent slopes

This deep, nearly level and gently sloping, somewhat poorly drained soil is in convex and concave areas on ground moraines. Most areas are long and narrow or irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark yellowish brown silt loam about 6 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 3 inches thick. Below this is dark yellowish brown and pale brown, mottled silt loam about 7 inches thick. The subsoil is about 14 inches thick. It is mottled. It is yellowish brown silt loam in the upper part and dark brown fine sandy loam in the lower part. The next layer is dark brown, mottled gravelly fine sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is brown, mottled extremely gravelly loamy coarse sand. In some places the silty deposits are less than 15 inches thick. In other places

the upper part of the soil is gravelly silt loam, gravelly loam, or loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Moberg soils, the well drained Marathon soils, the somewhat poorly drained Rietbrock and Withee soils, and the poorly drained and very poorly drained Sherry soils. Moberg and Marathon soils are in the higher landscape positions. Rietbrock and Withee soils are in landscape positions similar to those of the Mylrea soil. They have more clay in the subsoil than does the Mylrea soil. Also, Rietbrock soils have bedrock at a depth of 40 to 60 inches. Sherry soils are in drainageways and depressions. Also included are areas of Mylrea soils that have cobbles, stones, boulders in the surface layer and areas of bedrock outcrop. Inclusions make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Mylrea soil and rapid in the substratum. Surface runoff is slow or medium. Available water capacity is moderate. The organic matter content in the surface layer also is moderate. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Many areas of this soil are used as woodland. Some are used as cropland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, terraces, diversions, cover crops, and contour stripcropping help to prevent excessive soil loss. Excess water is a problem, mainly in the less sloping areas. It limits the choice of crops or results in crop damage in most years. It also delays field preparation, planting, or harvest. Land smoothing, surface drains, and diversions help to remove this water.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3W.

## MzB—Mylrea silt loam, 1 to 6 percent slopes, stony

This deep, nearly level and gently sloping, somewhat poorly drained soil is in convex and concave areas on ground moraines. Many cobbles, stones, and boulders are in the surface layer. Most areas are long and narrow or irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 10 inches thick. The subsoil is about 15 inches thick. It is dark brown and mottled. It is silt loam in the upper part and loam in the lower part. The next layer is strong brown gravelly sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is strong brown extremely gravelly loamy coarse sand. In places the surface layer is loam, gravelly loam, or gravelly silt loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Moberg soils, the well drained Marathon soils, the somewhat poorly

drained Rietbrock and Withee soils, and the poorly drained and very poorly drained Sherry soils. Moberg and Marathon soils are in the higher landscape positions. Rietbrock and Withee soils are in landscape positions similar to those of the Mylrea soil. They have more clay in the subsoil than does the Mylrea soil. Also, Rietbrock soils have bedrock at a depth of 40 to 60 inches. Sherry soils are in drainageways and depressions. Also included are areas of Mylrea soils that do not have cobbles, stones, and boulders in the surface layer and areas of bedrock outcrop. Inclusions make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Mylrea soil and rapid in the substratum. Available water capacity is moderate. The organic matter content in the surface layer is moderate or high. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as woodland. A few are used for pasture or wildlife habitat.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay and pasture because of wetness and the many cobbles, stones, boulders, and rock outcrops on the surface.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the stones and the wetness. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIIs. The woodland ordination symbol is 3X.

## Ne—Newson mucky loamy sand, 0 to 1 percent slopes

This deep, nearly level, poorly drained and very poorly drained soil is in drainageways and depressions on outwash plains, stream terraces, or glacial lake basins. It is subject to ponding. Most areas are long and narrow or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is black mucky loamy sand about 3 inches thick. The subsoil is grayish brown, mottled loamy sand about 9 inches thick. The next layer is grayish brown sand about 11 inches thick. The substratum to a depth of about 60 inches is grayish brown sand. In some places the surface layer is loamy sand or sandy loam. In other places the upper part of the soil is muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Meehan soils in the higher landscape positions. Also included are small areas of Minocqua soils in landscape positions similar to those of the Newson soil. Minocqua soils have more silt and clay in the surface layer and subsoil than does the Newson soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is rapid in this Newson soil. Available water capacity is low. The organic matter content in the surface layer is high or very high. During wet periods a seasonal high water table is within a depth of 1 foot.

Most areas of this soil are used as wildlife habitat. A few are used as cropland, pasture, or woodland.

Undrained areas are generally unsuitable as cropland because of wetness and because of frost late in spring and early in fall. Drainage of most areas is impractical because of a lack of adequate outlets. A few areas can be drained by open ditches. If drained, this soil is suited to oats and to clover and timothy for rotational hay and pasture. It is generally unsuited to corn because of the hazard of freezing. If drained, it is subject to soil blowing. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping,

cover crops, and a cropping system that includes rotational hay and pasture help to prevent excessive soil loss.

Drained areas are suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock reduces the seedling mortality rate. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the ponding, this soil is generally unsuited to septic tank absorption fields and dwellings. Overcoming this hazard is difficult.

Because of the ponding, this soil is poorly suited to local roads. This hazard can be overcome by removing the surface water through culverts and ditches or by adding fill material to raise the roads above the ponding level. Culverts also help to prevent road damage by equalizing the water level on each side of the road.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 6W.

## Oe—Oesterle loam, 0 to 2 percent slopes

This deep, nearly level, somewhat poorly drained soil is on flats adjacent to depressions and drainageways on outwash plains and stream terraces. Most areas are long and narrow or irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The next layer is brown, dark yellowish brown, and dark brown, mottled sandy loam about 7 inches thick. The subsoil is about 16 inches thick. It is mottled. It is dark brown sandy loam in the upper part and light yellowish brown loamy sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown, mottled sand. In some places thin strata of sandy loam, loamy sand, loam, or silt loam are in the substratum. In other places the surface layer is sandy loam. In some areas the upper part of the soil is loamy sand or silt loam.

Included with this soil in mapping are small areas of the moderately well drained Mahtomedi and Scott Lake soils and the poorly drained and very poorly drained Minocqua soils. Mahtomedi and Scott Lake soils are in the slightly higher landscape positions. Minocqua soils are in depressions and drainageways. Also included are small areas of Meehan soils in landscape positions similar to those of the Oesterle soil. Meehan soils have more sand and less silt and clay in the surface layer and subsoil than does the Oesterle soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the upper part of the subsoil in this Oesterle soil and rapid in the substratum. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderate. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Unless the soil is adequately drained, excess water limits the choice of crops or results in crop damage in most years. It also delays field preparation, planting, and harvesting. Controlled open ditch or tile drainage is needed to lower the water table. Where this soil is drained, however, crop yields are limited by the low available water capacity. Irrigation can supplement rainfall. Proper management of crop residue and green manure crops help to maintain or increase organic matter content and conserve moisture.

This soil is suited to permanent pasture and hay. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb the effluent but does not adequately filter it. The poor filtering capacity

can result in the pollution of ground water. In some areas both of these limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, or constructing the basement above the level of wetness helps to overcome this limitation. Otherwise, the wetness can be reduced by installing a subsurface system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by installing a subsurface drainage system in the roadbed or by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIw. The woodland ordination symbol is 3W.

## Pg—Pits, gravel

This map unit occurs as areas where sand and gravel or weathered bedrock has been removed to a depth of at least several feet. Most areas are irregular in shape and range from about 4 to 160 acres in size.

Typically, the material remaining on the bottom and sidewalls of the pits is sand and gravel; weathered, soft sandstone; or gravelly and sandy material weathered from coarse grained granite, which is locally known as rotten granite.

Included in mapping are areas of spoil from the excavated pits. The spoil includes soil material that was pushed from the pit area before excavation and piles of other discarded material, such as stones or boulders that are too large to be crushed.

Many pits are still in use; however, other pits have been abandoned. Some of the spoil areas are overgrown with trees, brush, and weeds. Some abandoned pits have water in them. In reclaiming the areas, land shaping and the addition of suitable topsoil generally are required to establish a plant cover.

Onsite investigation is needed to determine the suitability of the pit areas for septic tank absorption fields, for dwellings, and for local roads and streets.

This map unit has not been assigned a land capability classification or a woodland ordination symbol.

## Ph—Pits, quarries

This map unit occurs as areas where bedrock has been removed to a depth of at least several feet. Most areas are irregular in shape and range from about 4 to 160 acres in size.

Typically, the material remaining on the bottom and sidewalls of the quarries is dark, fine grained igneous rock; quartzite; hard sandstone; or reddish igneous rock, commonly known as red granite.

Included in mapping is spoil from the excavated pits. The spoil includes soil material that was pushed from the pit area before excavation and piles of other discarded material, such as stones or boulders.

Many pits are still in use; however, other pits have been abandoned. Some of the spoil areas are overgrown with trees, brush, and weeds. Some abandoned pits have water in them. Reclamation of these pits is difficult and generally is impractical.

These pits are unsuited to septic tank absorption fields, to dwellings with or without basements, and to local roads and streets because of the slope, ponded water, and exposed bedrock.

This map unit has not been assigned a land capability classification or a woodland ordination symbol.

## Po—Plover sandy loam, 0 to 2 percent slopes

This deep, nearly level, somewhat poorly drained soil is on slightly concave flats in glacial lake basins, on delta kames, and on stream terraces. Most areas are irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsurface layer is brown, mottled sandy loam about 7 inches thick. The next layer is dark brown and brown, mottled sandy loam about 14 inches thick. The subsoil is about 14 inches thick. It is dark brown and mottled. It is sandy loam in the upper part and loam in the lower part. The upper part of the substratum is dark brown, mottled, stratified sandy loam and loamy fine sand. The lower part to a depth of about 60 inches is yellowish brown, mottled, stratified sand and sandy loam. In some places the upper part of the soil is loamy sand, loam, or silt loam. In other places the substratum is sand and gravel.

Included with this soil in mapping are small areas of the moderately well drained Alban and Graycalm soils in the slightly higher landscape positions and areas of

the poorly drained and very poorly drained Minocqua soils in depressions and drainageways. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in this Plover soil. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer also is moderate. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Unless the soil is adequately drained, excess water limits the choice of crops or results in crop damage most years. It also delays field preparation, planting, or harvest. Land smoothing, surface drains, and open ditches help to remove this water.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIw. The woodland ordination symbol is 3W.

## RbC—Ribhill cobbly silt loam, 6 to 15 percent slopes, stony

This moderately deep, sloping and moderately steep, well drained soil is on the tops and sides of ridges and hills on quartzite monadnocks. Many stones and cobbles are in the surface layer. Most areas are long and narrow or irregular in shape and range from about 20 to 1,280 acres in size.

Typically, the surface layer is very dark brown cobbly silt loam about 4 inches thick. The next layer is dark brown cobbly silt loam about 6 inches thick. The next layer is brown and dark yellowish brown cobbly silt loam about 13 inches thick. The subsoil is dark yellowish brown very cobbly silt loam about 12 inches thick. Fractured quartzite bedrock is at a depth of about 35 inches. The depth to quartzite bedrock ranges from 20 to 40 inches. In places the slope is less than 6 or more than 15 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Rietbrock soils in the lower landscape positions. Also included are small areas of Ribhill soils that have bedrock at a depth more than 40 inches, areas of rock outcrops, and areas of soils that have bedrock within a depth of 20 inches. Inclusions make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in this Ribhill soil. Available water capacity is low. The organic matter content in the surface layer is high or very high.

Most areas of this soil are used as woodland. A few are used for recreation, pasture, or wildlife habitat.

This soil is generally unsuited to use as cropland, hayland, or pasture because of the slope and the many cobbles, stones, and rock outcrops.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the cobbles, stones, and rock outcrops. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the depth to bedrock, seepage of effluent into fractures and cracks in the bedrock, and the large stones, this soil is generally unsuited to septic tank absorption fields. Because of the depth to bedrock and the large stones, it is generally unsuited to dwellings. Overcoming these limitations is difficult.

Because of the large stones, this soil is poorly suited to local roads and streets. The stones can be removed by hand or by mechanical means. Otherwise, additions of suitable fill material can raise the roadbed a sufficient distance above the stones.

The land capability classification is VIs. The woodland ordination symbol is 4X.

## RbE—Ribhill cobbly silt loam, 15 to 30 percent slopes, stony

This moderately deep, moderately steep and steep, well drained soil is on the sides of ridges and hills on quartzite monadnocks. Many stones and cobbles are in the surface layer. Most areas are long and narrow or irregular in shape and range from about 20 to 320 acres in size.

Typically, the surface layer is very dark brown cobbly silt loam about 3 inches thick. The next layer is dark brown cobbly silt loam about 7 inches thick. Below this is brown and dark yellowish brown cobbly silt loam about 4 inches thick. The subsoil is about 16 inches thick. It is dark yellowish brown cobbly silt loam in the upper part and yellowish brown very cobbly silt loam in the lower part. Fractured quartzite bedrock is at a depth of about 30 inches. The depth to hard bedrock ranges from 20 to 40 inches. In places the slope is less than 15 or more than 30 percent.

Included with this soil in mapping are small areas of Ribhill soils that have bedrock at a depth of more than 40 inches and areas of rock outcrops. Also included are areas of soils that have bedrock within a depth of 20 inches. Inclusions make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in this Ribhill soil. Available water capacity is low. The organic matter content in the surface layer is high or very high.

Most areas of this soil are used as woodland. Some are used for recreation and wildlife habitat.

This soil is generally unsuited to use as cropland, hayland, or pasture because of the slope and the many cobbles, stones, and rock outcrops.

This soil is suited to trees. The slope and plant competition are the main management concerns. Also, the use of planting and harvesting equipment is limited by the cobbles, stones, and rock outcrops. Seedling survival on the steeper slopes facing south or west can be improved by carefully planting vigorous nursery stock. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical means.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the depth to bedrock, seepage of effluent into fractures and cracks in the bedrock, and the large stones, this soil is generally unsuited to septic tank absorption fields. It is generally unsuited to dwellings because of the depth to bedrock, the slope, and the large stones. Overcoming these limitations is difficult.

This soil is poorly suited to local roads because of the slope and the large stones. The slope can be reduced by cutting and filling. The cutting and filling can expose the bedrock, which in turn can be removed by blasting or by using a jackhammer or other suitable power equipment. The large stones can be removed by mechanical means. Otherwise, additions of suitable fill material can raise the roadbed a sufficient distance above the stones.

The land capability classification is VIIs. The woodland ordination symbol is 4R.

## RcB—Rietbrock silt loam, 1 to 8 percent slopes

This deep, nearly level to sloping, somewhat poorly drained soil is along the edges of drainageways, at the base of slopes, and on the convex or concave tops of broad knolls on ground moraines and uplands. Most areas are irregular in shape or long and narrow and range from about 10 to 360 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 3 inches thick. The next 11 inches is brown, mottled silt loam and dark brown, mottled loam. The subsoil is about 23 inches thick. It is dark brown and mottled. It is gravelly loam in the upper part, gravelly clay loam in the next part, and cobbly loam in the lower part. Shattered igneous and metamorphic bedrock is at a depth of about 45 inches. The depth to hard bedrock ranges from 40 to 60 inches. In some places the upper part of the soil is loam or sandy loam. In other places the slope is less than 1 or more than 8 percent.

Included with this soil in mapping are small areas of Dolph, Fenwood, Loyal, Meadland, Mylrea, Sherry, and Withee soils. Dolph, Meadland, Mylrea, and Withee soils are in landscape positions similar to those the Rietbrock soil. They do not have bedrock within a depth of 60 inches. The well drained Fenwood and moderately well drained Loyal soils are in the higher landscape positions. Loyal soils do not have bedrock within a depth of 60 inches. The poorly drained and very poorly drained Sherry soils are in depressions and drainageways. Also included are small areas of Rietbrock soils that have cobbles and stones in the surface layer and areas of soils that have

bedrock within a depth of 40 inches. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately slow in this Rietbrock soil. Surface runoff is slow or medium. Available water capacity is moderate. The organic matter content in the surface layer also is moderate. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, terraces, diversions, cover crops, and contour stripcropping help to prevent excessive soil loss. Construction of the terraces and diversions is limited by the gravelly and cobbly subsoil and the bedrock. Excess water also is a problem, mainly in the less sloping areas. It limits the choice of crops or results in crop damage in most years. It also delays field preparation, planting, or harvest. Land smoothing, surface drains, and diversions help to remove this water. Hillside seeps and springs are common on this soil. Excess water from these areas can be removed by diversions, tile drains, and grassed waterways. The depth to which the tile can be installed, however, is limited by the gravelly and cobbly subsoil and the bedrock.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3W.

## ReB—Rietbrock silt loam, 1 to 8 percent slopes, stony

This deep, nearly level to sloping, somewhat poorly drained soil is on the convex or concave tops of broad knolls, at the base of slopes, and along the edges of drainageways on ground moraines and uplands. Many cobbles and stones are in the surface layer. Most areas are long and narrow or irregular in shape and range from about 10 to 640 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is brown, mottled silt loam about 4 inches thick. The next layer is about 11 inches thick. It is mottled. It is brown silt loam and dark brown loam. The subsoil is about 22 inches thick. It is dark brown and mottled. It is gravelly loam in the upper part and cobbly loam in the lower part. Shattered igneous and metamorphic bedrock is at a depth of about 42 inches. The depth to hard bedrock ranges from 40 to 60 inches. In places the upper part of the soil is loam, sandy loam, or gravelly loam.

Included with this soil in mapping are small areas of the well drained Fenwood soils in the higher landscape positions and areas of the poorly drained and very poorly drained Sherry soils in drainageways and depressions. Also included are small areas of Rietbrock soils that do not have cobbles and stones in the surface layer or have bedrock at a depth of more than 60 inches, areas of soils that have bedrock within a depth of 40 inches, and areas of rock outcrops. Inclusions make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately slow in this Rietbrock soil. Available water capacity is moderate. The organic matter content in the surface layer is moderate or high. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as woodland. A few are used for pasture or wildlife habitat.

This soil is generally unsuited to corn and small grain and to grasses and legumes for rotational hay and pasture because of wetness and cobbles, stones, and rock outcrops on the surface.

This soil is suited to trees. The use of planting and harvesting equipment is limited by the cobbles, stones, and rock outcrops and by the wetness. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIIs. The woodland ordination symbol is 3X.

## RhA—Rockers loamy sand, 0 to 3 percent slopes

This deep, nearly level and gently sloping, somewhat poorly drained soil is in slightly convex and concave areas on ground moraines. Most areas are long and narrow or irregular in shape and range from about 4 to 200 acres in size.

Typically, the surface layer is black loamy sand about 3 inches thick. The subsurface layer is grayish brown loamy sand about 3 inches thick. The upper part of the subsoil is about 12 inches thick. It is dark reddish brown loamy sand and dark brown, mottled loamy sand. The next layer is brown and dark yellowish brown, mottled loamy sand about 9 inches thick. The lower part of the subsoil is grayish brown, mottled gravelly loam about 11 inches thick. The substratum to a depth of about 60 inches is dark brown, mottled gravelly sandy loam. In places the upper part of the soil is sandy loam.

Included with this soil in mapping are small areas of the moderately well drained Guenther soils and the poorly drained Dancy soils. Guenther soils are in the higher landscape positions. Dancy soils are in drainageways and depressions. Also included are small areas of the Rockers soils that have cobbles and stones in the surface layer or have bedrock at a depth of less than 60 inches and small areas of Meadland soils in landscape positions similar to those of the Rockers soil. Meadland soils have more silt and clay and less sand in the upper part than does the Rockers soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the upper part of the subsoil in this Rockers soil and moderately slow in the substratum. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer is moderately low. During wet periods a seasonal high water table is at a depth of 1 to 3 feet.

Many areas of this soil are used as woodland. Some are used as cropland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Unless the soil is adequately drained, excess water limits the choice of crops or results in crop damage in most years. It also delays field preparation, planting, or harvest. Land smoothing, surface drains, and diversions help to remove this water. The soil is subject to soil blowing. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, cover crops, wind stripcropping, and field windbreaks help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also help to prevent excessive soil loss. Proper management of crop residue and green manure crops help to control soil blowing, maintain or increase the organic matter content, and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut

or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, or constructing basements above the level of wetness helps to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is poorly suited to local roads and streets. This limitation can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, or by installing a good surface and subsurface drainage system.

The land capability classification is IIIw. The woodland ordination symbol is 3W.

## RoA—Rosholt sandy loam, 0 to 2 percent slopes

This deep, nearly level, well drained soil is on flats on outwash plains and stream terraces. Most areas are irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The next layer is brown and dark brown sandy loam about 10 inches thick. The subsoil is about 13 inches thick. It is dark brown sandy loam in the upper part and strong brown loamy sand in the lower part. The substratum to a depth of about 60 inches is strong brown gravelly sand. In some places the surface layer is loam or loamy sand. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the moderately well drained Scott Lake soils in the slightly lower landscape positions. Also included are small areas of Chetek soils in landscape positions similar to those of the Rosholt soil and small areas of Rosholt soils that have cobbles in the surface layer and subsoil. Chetek soils have a thinner solum than does the Rosholt soil and are somewhat excessively drained. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Rosholt soil and rapid in the substratum. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderately low or moderate.

Most areas of this soil are used as cropland. A few are used as woodland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. It tends to be droughty during periods of low rainfall. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, this soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, and field windbreaks help to prevent excessive soil loss. A cropping system that includes rotational hay and pasture also is effective in preventing excessive soil loss. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

This soil is suited to dwellings. Because of frost action, it is only moderately suited to local roads and streets. This limitation can be overcome by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIs. The woodland ordination symbol is 3L.

## RoB—Rosholt sandy loam, 2 to 6 percent slopes

This deep, gently sloping, well drained soil is in convex and concave areas on outwash plains and stream terraces. Most areas are irregular in shape and range from about 10 to 400 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The next layer is brown and dark brown sandy loam about 7 inches thick. The subsoil is about 13 inches thick. It is dark brown. It is gravelly sandy loam in the upper part and very gravelly loamy coarse sand in the lower part. The substratum to a depth of about 60 inches is brown and reddish yellow very gravelly sand. In some places the upper part of the soil is loam or loamy sand. In other places the substratum is loamy sand. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the moderately well drained Scott Lake soils in the slightly lower landscape positions. Also included are small areas of Chetek soils in landscape positions similar to those of the Rosholt soil and small areas of Rosholt soils that have cobbles in the surface layer and subsoil. Chetek soils have a thinner solum than does the Rosholt soil and are somewhat excessively drained. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Rosholt soil and rapid in the substratum. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderately low or moderate.

Many areas are used as cropland. Some are used as woodland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a slight or moderate hazard. Also soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, and contour farming help to prevent excessive water erosion. Wind stripcropping, cover crops, conservation tillage, and field windbreaks reduce the hazard of soil blowing. A cropping system that includes rotational hay and pasture also is effective in preventing excessive soil loss. The soil tends to be droughty during periods of low rainfall. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

This soil is suited to dwellings. Because of frost action, it is only moderately suited to local roads and streets. This limitation can be overcome by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3L.

## RsA—Rosholt silt loam, 0 to 2 percent slopes

This deep, nearly level, well drained soil is on flats on outwash plains and stream terraces. Most areas are irregular in shape and range from about 4 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The next layer is about 17 inches thick. It is brown and dark brown. It is silt loam in the upper part and loam in the lower part. The subsoil is about 14 inches thick. It is dark brown. It is loam in the upper part and gravelly sandy loam in the lower part. The substratum to a depth of about 60 inches is brown very gravelly sand. In some places the upper part of the soil is fine sandy loam or loam. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the moderately well drained Scott Lake soils in the

slightly lower landscape positions. These soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Rosholt soil and rapid in the substratum. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer also is moderate.

Most areas of this soil are used as cropland. A few are used as woodland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. It tends to be droughty during periods of low rainfall. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Proper management of crop residue and green manure crops increase the rate of water infiltration, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

This soil is suited to dwellings. Because of frost action, it is only moderately suited to local roads and streets. This limitation can be overcome by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIs. The woodland ordination symbol is 3L.

## RsB—Rosholt silt loam, 2 to 6 percent slopes

This deep, gently sloping, well drained soil is in convex and concave areas on outwash plains and stream terraces. Most areas are irregular in shape and range from about 4 to 120 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The next layer is about 11 inches thick. It is brown and dark brown. It is silt loam in the upper part and loam in the lower part. The subsoil is about 16 inches thick. It is dark brown. It is loam in the upper part and gravelly sandy loam in the lower part. The substratum to a depth of about 60 inches is strong brown very gravelly sand. In some places the upper part of the soil is fine sandy loam or loam. In other places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the moderately well drained Scott Lake soils in the slightly lower landscape positions. These soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate or moderately rapid in the subsoil of this Rosholt soil and rapid in the substratum. Surface runoff is slow or medium. Available water capacity is moderate. The organic matter content in the surface layer also is moderate.

Many areas of this soil are used as cropland. Some areas are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. If this soil is cultivated, water erosion is a slight or moderate hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, contour stripcropping, and contour farming help to prevent excessive soil loss. A cropping system that includes rotational hay or pasture also is effective in controlling water erosion. The soil tends to be droughty during periods of low rainfall. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Proper management of crop residue and green manure crops help to prevent excessive soil loss, increase the rate of water infiltration, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled

by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

This soil can readily absorb the effluent in septic tank absorption fields but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water.

This soil is suited to dwellings. Because of frost action, it is only moderately suited to local roads and streets. This limitation can be overcome by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3L.

## ScA—Scott Lake sandy loam, 0 to 3 percent slopes

This deep, nearly level and gently sloping, moderately well drained soil is on broad or narrow flats adjacent to lower lying depressions on outwash plains and stream terraces. Most areas are irregular in shape and range from about 4 to 120 acres in size.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The next layer is brown and dark brown sandy loam about 14 inches thick. The subsoil is about 11 inches thick. It is dark brown sandy loam in the upper part and strong brown, mottled loamy sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown, mottled gravelly coarse sand. In places the upper part of the soil is loam or loamy sand.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek soils, the well drained Rosholt soils, and the somewhat poorly drained Oesterle soils. Chetek and Rosholt soils are in the slightly higher landscape positions. Oesterle soils are in the slightly lower positions. Also included are small areas of Mahtomedi soils in landscape positions similar to those of the Scott Lake soil. Mahtomedi soils have more sand and less silt and clay in the surface layer and subsoil than does the Scott Lake soil. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Scott Lake soil and rapid in the substratum. Surface runoff is slow. Available water capacity is low. The organic matter content in the surface layer is moderately low or moderate. During wet periods a seasonal high water table is at a depth of 2.5 to 6.0 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. It tends to be droughty during periods of low rainfall. Where an adequate water supply is available, irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Soil blowing is a hazard. Conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, wind stripcropping, cover crops, field windbreaks, and a cropping system that includes rotational hay and pasture help to prevent excessive soil loss. Proper management of crop residue and green manure crops help to prevent excessive soil loss, maintain or increase the organic matter content, and conserve moisture.

This soil is suited to permanent pasture and hayland. During periods of low rainfall, however, yields are reduced because of the low available water capacity. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb effluent but does not adequately filter it. The poor filtering capacity can result in the pollution of ground water. In some areas both of the limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is only moderately suited to dwellings with basements. It is suited to dwellings without basements. The basement can be constructed above the level of wetness. Otherwise, the wetness can be reduced by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is only moderately suited to local roads and streets. This limitation can be overcome by installing a subsurface drainage system in the roadbed or by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIs. The woodland ordination symbol is 3L.

## SdA—Scott Lake silt loam, 0 to 3 percent slopes

This deep, nearly level and gently sloping, moderately well drained soil is on broad or narrow flats adjacent to lower lying depressions on outwash plains and stream terraces. Most areas are irregular in shape and range from about 4 to 120 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The next layer is about 15 inches thick. It is brown and dark yellowish brown silt loam in the upper part and dark brown loam in the lower part. The subsoil is about 8 inches thick. It is mottled. It is dark brown loam in the upper part and yellowish red sandy loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown, mottled sand. In places the upper part of the soil is loam or fine sandy loam.

Included with this soil in mapping are small areas of the well drained Rosholt soils and the somewhat poorly drained Oesterle soils. Rosholt soils are in the slightly higher landscape positions. Oesterle soils are in the slightly lower positions. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the subsoil of this Scott Lake soil and rapid in the substratum. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer also is moderate. During wet periods a seasonal high water table is at a depth of 2.5 to 6.0 feet.

Many areas of this soil are used as cropland. Some are used as woodland. A few are used for pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. It also is suited to ginseng. It tends to be droughty during periods of low rainfall. Where an adequate water supply is available, sprinkler irrigation can supplement rainfall. If irrigated, the soil is suited to vegetable crops, such as potatoes, sweet corn, and snap beans. Proper management of crop residue and green manure crops help to maintain or increase the organic matter content and conserve moisture.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of low soil strength, the use of harvesting or planting equipment is limited during the spring thaw and during extended periods of high rainfall. This limitation can be overcome by restricting the use of equipment during these times. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It can readily absorb but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. In some areas both of the limitations can be overcome by constructing a mound of suitable filtering material. In places the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is only moderately suited to dwellings with basements. It is suited to dwellings without basements. The basement can be constructed above the level of wetness. Otherwise, the wetness can be reduced by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

Because of frost action, this soil is only moderately suited to local roads and streets. This limitation can be overcome by installing a subsurface drainage system in the roadbed or by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIs. The woodland ordination symbol is 3L.

## Se—Seelyeville muck, 0 to 1 percent slopes

This deep, nearly level, very poorly drained soil is in bogs, depressions, and drainageways on outwash plains, glacial lake plains, and ground moraines. It is subject to ponding. Most areas are irregular in shape and range from about 4 to 400 acres in size.

Typically, black muck extends to a depth of at least 60 inches. In some places the surface layer is peat. In other places sandy or loamy deposits are at a depth of 16 to 51 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Hatley and Oesterle

soils in the higher landscape positions. These soils make up about 5 to 10 percent of individual mapped areas.

Permeability is moderately slow to moderately rapid in this Seelyeville soil. Available water capacity is very high. The organic matter content also is very high. During wet periods a seasonal high water table is at or above the surface.

Many areas of this soil are used as wetland wildlife habitat. Some are used as woodland.

Undrained areas are generally unsuited to cultivated crops because of wetness and because of frost late in spring and early in fall. Most areas cannot be drained because of a lack of adequate outlets, but a few areas can be drained by open ditches. Drained areas are suited to oats and to grasses and legumes for rotational hay and pasture. This soil is generally unsuited to corn because of the hazard of freezing. If drained and used as cropland, the soil is subject to subsidence and soil blowing. A system of controlled drainage that keeps the water table directly below the root zone of the crops reduces the susceptibility to subsidence and soil blowing. Field windbreaks, wind stripcropping, and cover crops also help to control soil blowing.

Drained areas are suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, reforestation is limited to natural regeneration. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

This soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets because of ponding and subsidence. Overcoming these limitations is difficult.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 8W.

## ShA—Sherry silt loam, 0 to 3 percent slopes

This deep, nearly level and gently sloping, poorly drained and very poorly drained soil is in drainageways and depressions on ground moraines. It is subject to ponding. Most areas are long and narrow or irregular in shape and range from about 4 to 280 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown, mottled silt loam about 8 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 5 inches thick. The subsoil is about 25 inches thick. It is mottled. It is light brownish gray silt loam in the upper part, grayish brown silt loam in the next part, and brown loam in the lower part. The next layer is dark brown, mottled loam about 6 inches thick. The substratum to a depth of about 60 inches is multicolored loam. In some places the upper part of the soil is loamy sand, sandy loam, or loam. In other places the subsoil and substratum are clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Meadland, Mylrea, Rietbrock, and Withee soils in the higher landscape positions. Also included are areas of Sherry soils that have cobbles and stones in the surface layer. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderately slow or moderate in the upper part of this Sherry soil and moderately slow in the lower part. Surface runoff is very slow or ponded. Available water capacity is high. The organic matter content in the surface layer is high or very high. During wet periods a seasonal high water table is within a depth of 1 foot.

Many areas of this soil are used as woodland. A few are used as cropland or pasture.

Undrained areas are generally unsuitable as cropland because of the wetness and the hazard of frost late in spring and early in fall. If drained, this soil is suited to oats and to clover and timothy for rotational hay and pasture. It is generally unsuited to corn because of the hazard of freezing. Land smoothing and surface drains help to remove excess water. Cleared areas in intermittent drainageways can be used as grassed waterways.

Drained areas are suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock helps to overcome seedling mortality. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees.

Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of wetland wildlife habitat. Shallow ponds can be excavated, and the vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the ponding and the moderately slow permeability, this soil is generally unsuited to septic tank absorption fields. Because of the ponding, it is generally unsuited to dwellings. Overcoming these limitations is difficult.

This soil is poorly suited to local roads because of the ponding and frost action. The ponding can be overcome by removing the surface water through culverts and ditches or by adding fill material to raise the roads above the ponding level. Culverts also help to prevent road damage by equalizing the water level on each side of the road. The potential for frost action can be reduced by excavating the upper part of the soil and replacing it with coarse textured base material, such as sand or gravel.

The land capability classification is VIw in undrained areas and IIIw in drained areas. The woodland ordination symbol is 3W.

## St—Sturgeon silt loam, 0 to 2 percent slopes

This deep, nearly level, somewhat poorly drained soil is in convex areas on flood plains and on islands in large rivers. Many areas have been dissected by overflow channels. The soil is subject to occasional flooding of brief duration. Individual areas are long and narrow or irregular in shape and range from about 4 to 120 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper 10 inches of the substratum is dark yellowish brown silt loam. The next 13 inches is dark brown, mottled, stratified silt loam, sandy loam, and loam. The next 10 inches is dark yellowish brown, mottled sand. The lower part of the substratum to a depth of about 60 inches is brown sand. In some places the surface layer and the upper part of the substratum are loam, fine sandy loam, or sandy loam. In other places the lower part of the substratum is gravelly or very gravelly sand.

Included with this soil in mapping are small areas of the moderately well drained Dunnville soils in the higher landscape positions and small areas of the poorly drained and very poorly drained Fordum soils in the lower positions. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the loamy upper part of this Sturgeon soil and rapid in the sandy lower part. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer also is moderate. During wet periods a seasonal high water table is at a depth of 0.5 foot to 1.5 feet.

Many areas of this soil are used as woodland. A few are used as cropland, pasture, or wildlife habitat.

Because of the wetness and the hazard of flooding, this soil is poorly suited to corn and small grain and to grasses and legumes for rotational hay and pasture. Many areas are inaccessible because they are separated from the uplands by areas of water or the included Fordum soils. A few areas can be artificially drained, protected from flooding, and used as cropland, but excess water limits the choice of crops or results in crop damage in most years. The wetness also delays field preparation, planting, or harvest. Proper management of crop residue and green manure crops help to maintain or increase the organic matter content and increase the rate of water infiltration.

This soil is suited to permanent pasture and hayland. The wetness and the flooding, however, limit the kind of plants that can be grown. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock reduces the seedling mortality rate. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applying suitable herbicides or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the flooding and the wetness, this soil generally is unsuited to septic tank absorption fields and dwellings. Overcoming these limitations is difficult.

This soil is poorly suited to local roads because of the wetness, the flooding, and frost action. Fill material can be used to raise the roadbed above the wetness level. The hazard of flooding can be reduced by building on fill material, which can raise the roads above the level of flooding, and by establishing stable overflow sections. Covering a dip in the road with strong concrete and installing riprap on the roadsides help to establish these stable sections. Installing large bridges and culverts permits the floodwater to drain

away from the site. The potential for frost action can be reduced by excavating the upper part of the soil and replacing it with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

## UoB—Udorthents, loamy, gently sloping

These moderately deep or deep, nearly level and gently sloping, somewhat poorly drained to well drained soils are mostly near or within urban areas and major highway interchanges. In these areas the original soil has been excavated or covered with fill. Most areas are irregular in shape and range from about 4 to 200 acres in size. Slope ranges from 0 to 6 percent.

Typically, these soils are loamy and have a wide range of color. The thickness of the fill or depth of excavation is more than 3 feet. In many places topsoil has been spread over the surface so that vegetation can grow. In some areas the slope is more than 6 percent.

Included in mapping are small areas that have not been excavated or filled, areas covered with buildings, roads, and parking lots, and areas where the fill is nonsoil material, such as broken concrete, stones, boulders, wood, or other trash. Also included are areas where the fill is sand, gravel, or sand and gravel and gravel pits that have been reshaped and revegetated. Included areas make up about 10 to 15 percent of the map unit.

These soils have a seasonal high water table at a depth of 1 foot to more than 5 feet. Permeability and available water capacity vary. The depth to bedrock is 20 inches to more than 60 inches.

Most areas are used for urban development or as highway rights-of-way. A few are used as cropland or pasture or have been planted to trees or shrubs. The present use of these soils, or their variable nature, make it difficult to rate the suitability for cultivated crops, pasture, and trees without onsite investigation. In most areas, erosion is a hazard and a plant cover is needed. In cultivated areas conservation tillage practices, such as chisel planting, that leave a protective amount of crop residue on the surface, cover crops, or stripcropping helps to prevent excessive soil loss.

The suitability of these soils for septic tank absorption fields, dwellings with or without basements, and local roads and streets can be determined only by onsite investigation.

These soils are not assigned a land capability classification or a woodland ordination symbol.

## UoE—Udorthents, loamy, steep (earthen dam)

This map unit consists of loamy soil material used as a structure for impounding water.

No land capability classification has been assigned.

## WtA, WtB—Withee silt loam, 0 to 3 percent slopes

This deep, nearly level and gently sloping, somewhat poorly drained soil is in concave areas on broad ground moraines. Most areas are irregular in shape and range from about 4 to 1,000 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 5 inches thick. The next layer is about 19 inches thick. It is mottled. It is brown and dark brown silt loam in the upper part and dark brown loam and brown silt loam in the lower part. The subsoil is about 13 inches thick. It is reddish brown and mottled. It is clay loam in the upper part and sandy clay loam in the lower part. The substratum to a depth of about 60 inches is reddish brown sandy clay loam. In some places the subsoil and substratum are sandy loam, gravelly sandy loam, or gravelly sandy clay loam. In other places the substratum is loamy material weathered from igneous and metamorphic bedrock. In some areas the slope is more than 3 percent.

Included with this soil in mapping are small areas of the moderately well drained Loyal soils, the somewhat poorly drained Mylrea and Rietbrock soils, and the poorly drained Marshfield and Sherry soils. Also included are areas of Withee soils that have cobbles and stones in the surface layer. Mylrea and Rietbrock soils are in landscape positions similar to those of the Withee soil. Also, Mylrea soils have more gravel in the subsoil and substratum. Rietbrock soils have bedrock at a depth of 40 to 60 inches. Marshfield and Sherry soils are in drainageways and depressions. Included soils make up about 5 to 15 percent of individual mapped areas.

Permeability is moderate in the silty upper part of this Withee soil and very slow in the loamy till. Surface runoff is slow. Available water capacity is moderate. The organic matter content in the surface layer also is moderate. During wet periods a seasonal high water table is at a depth of 0.5 foot to 2.5 feet.

Many areas of this soil are used as cropland. A few are used as woodland or pasture.

This soil is suited to corn and small grain and to grasses and legumes for rotational hay and pasture. If this soil is cultivated, water erosion is a slight hazard. Excess water limits the choice of crops or results in crop damage in most years. It also delays field preparation, planting, and harvesting. Land smoothing, surface drains, and diversions help to remove this water. Leaving crop residue on the surface, adding other organic material to the soil, minimizing tillage, tilling and harvesting at the proper soil moisture content, and including grasses and legumes in the cropping sequence help to prevent excessive compaction, reduce crusting, and maintain good tilth.

This soil is suited to permanent pasture and hayland. Proper stocking rates, pasture renovation, rotational grazing, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Because of wetness, the trees should be planted by hand or machine on prepared ridges. Planting vigorous nursery stock reduces the seedling mortality rate. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation interferes with natural regeneration following harvest. It can be controlled by applications of suitable herbicide or by mechanical removal.

This soil is suited to the development of openland and woodland wildlife habitat. The vegetation that provides food and cover can be planted or can naturally regenerate.

Because of the wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field in better suited soils that are higher on the landscape.

Because of the wetness, this soil is poorly suited to dwellings. Building dwellings without basements on fill material, which raises the level of the site, and constructing basements above the level of wetness help to overcome this limitation. The wetness also can be overcome by installing a subsurface drainage system that has a dependable outlet, such as a gravity outlet.

This soil is poorly suited to local roads and streets because of the wetness and frost action. The wetness can be overcome by using fill material to raise the roadbed above the level of wetness; by installing a subsurface drainage system, which lowers the water table; or by increasing the thickness of the subbase. The potential for frost action can be reduced by installing a subsurface drainage system in the roadbed or by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIw. The woodland ordination symbol is 4W.

## Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 500,000 acres in the survey area, or nearly 50 percent of the total land acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in associations 1, 2, and 5, which are described under the heading "General Soil Map Units." About 330,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn and alfalfa, account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to

industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

# Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the suitability and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

## Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under “Detailed Soil Map Units.” Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

About 410,000 acres in Marathon County was used for crops and pasture in 1982, according to the Census of Agriculture. Of this total about 38,000 acres was used for permanent pasture; 94,000 acres for row crops, mainly corn; 42,000 acres for small grain, mainly oats; and 227,000 acres for hay and pasture. The rest was idle cropland.

The potential of the soils in Marathon County for increased production of crops is good. About 245,000 acres of potentially good cropland is used as woodland, and about 35,000 acres is used for pasture. In addition to the reserve capacity represented by this land, food production could also be increased considerably by extending better crop production technology to all parts of the county.

Water erosion is the major soil problem on about 75 percent of the cropland and pasture in Marathon County. Where the slope is more than 2 percent, water erosion is a hazard.

Loss of the surface layer through water erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Erosion is especially damaging on soils that have an acid subsoil, such as that of the Loyal soils. It is also damaging on soils that have a cobbly subsoil and bedrock at a depth of 40 to 60 inches, such as the Fenwood soils. Water erosion also reduces the productivity of soils that tend to be droughty, such as the Mahtomedi soils. Secondly, erosion on farmland results in the sedimentation of streams, reducing the quality of water available for municipal use, for recreation, and for fish and wildlife.

Water erosion can generally be controlled by

practices that provide a protective surface cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil losses to amounts small enough that yields will not be reduced. On dairy farms, which require pasture and hay, including forage crops of grasses and legumes in the cropping system reduces the hazard of water erosion on sloping land and also provides nitrogen and improves tilth for the other crops grown in the rotation.

Conservation tillage systems that leave protective amounts of crop residue on the surface, such as no-till, till-plant, chisel planting, and disk planting, increase the infiltration rate and reduce the runoff rate and the hazard of water erosion. These systems can be adapted to most of the soils in the county, but they are less successful on the poorly drained soils.

Terraces and diversions help to control runoff and water erosion by reducing the length of slopes. Contour farming and stripcropping also help to control runoff and water erosion. Grassed waterways prevent excessive water erosion in channels and increase the infiltration rate by slowing the velocity of runoff.

Soil blowing is a hazard on the sandy Graycalm, Guenther, Mahtomedi, Meehan, Newson, and Rockers soils and on the organic Cathro and Seeyleville soils. It also is a hazard on the Chetek, Dancy, Minocqua, Rosholt, and Scott Lake soils. 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. Maintaining a plant cover, surface mulching, wind stripcropping, and establishing field windbreaks minimize soil blowing on these soils.

A drainage system is a major management need on about 20 percent of the acreage used for crops and pasture in the county. Some soils are naturally so wet that it is generally not possible for them to produce the crops commonly grown in the county unless they are drained. These are poorly drained and very poorly drained soils, such as those of the Altdorf, Cable, Dancy, Marshfield, Minocqua, Newson, and Sherry series. Also in this category are organic soils, such as those of the Cathro and Seeyleville series.

Unless artificially drained, the somewhat poorly drained soils are so wet that the choice of crops is limited or crop damage results in most years. The wetness also delays field preparation, planting, or harvesting. These problems are evident in areas of the Dolph, Meadland, Meehan, Oesterle, Plover, and Rockers soils and the less sloping Hatley, Magnor, Mylrea, Rietbrock, and Withee soils.

The best design of both surface and subsurface drainage systems depends on the kind of soil and the site conditions. A combination of surface and subsurface drains is needed in most areas of the poorly drained and very poorly drained soils that are used for intensive row cropping. Diversions are needed in some areas to divert runoff from the adjacent slopes.

If organic soils are used as cropland, controlled drainage is necessary. When water is removed, the pore spaces fill with air and the organic material oxidizes and subsides. Special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required for 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.

Crops are subject to frost damage in most areas of poorly drained and very poorly drained soils because of a low position on the landscape. The number of frost-free growing days per season is less on these soils than on the adjacent upland soils because of cold air drainage to the lowlands.

Soil fertility varies in the soils of Marathon County, depending on the cropping history. Nearly all of the soils in the county have been weathered to a great depth and are now acid. If they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for the protection of alfalfa and other crops that grow best in nearly neutral soils.

In general, coarse textured and moderately coarse soils require less lime than medium textured soils. Available potash levels are naturally low in many soils of the county. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the desired level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Soil tilth is an important factor affecting the germination and emergence of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous. Tilling or grazing when the soil is too wet can cause poor tilth, especially on soils that have a loam or silt loam surface layer. Intense rainfall on bare soil can cause the formation of a surface crust that reduces the infiltration rate and increases the hazards of runoff and erosion. Maintaining good tilth is more difficult on eroded soils because they have a lower content of organic matter.

Returning crop residue to the soil and regularly adding manure or other organic material improve soil structure and tilth and help to prevent surface crusting.

Corn is the most common row crop grown in the county. It is used for grain or silage. Oats is the most common small grain. Wheat, barley, and rye are grown in small amounts. Because of the predominance of

dairying in the county, hay is an important crop. The dominant hay crop mixture is bromegrass and alfalfa, but red clover, alsike clover, and timothy are also grown. Birdsfoot trefoil is well adapted to the wet soils that are not sandy. The forage species grown on improved pasture are the same as those grown for hay, and much of the forage is cut and hauled to feeding areas.

Specialty crops grown commercially in the county are vegetables and ginseng. The most common vegetables are potatoes, sweet corn, and cucumbers.

Information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Natural Resources Conservation Service.

### Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents *(9)*. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

### Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(13)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

*Capability classes*, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards 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 or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

*Capability subclasses* are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used

in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

## Woodland Management and Productivity

George W. Alley, forester, Natural Resources Conservation Service, helped prepare this section.

Before settlement, Marathon County was entirely covered by forest. The forested area now is about 37 percent of the land area. The rest of the county has been cleared for agricultural or other uses. Most of the present forest is commercial. It is dominated by two forest types. Maple-birch makes up 43 percent of the total, and aspen-paper birch makes up 28 percent. The oak-hickory type grows on 5 percent, while elm-ash-soft maple, on the wetter soils, grows on about 4 percent. Approximately 2 percent of the total is mostly pine in areas of sandy soils. Fir, spruce, and cedar grow on about 1 percent. Nonstocked forest land accounts for the remaining commercial forest.

Ownership of woodland in Marathon County is concentrated in the private sector. Approximately 45 percent is in farm woodlots. Other private individuals and corporations own 35 percent. The forest industry owns about 9 percent of the forest area. Marathon County owns about 7 percent of the total, and state and Indian tribal forests account for the balance *(7)*.

The extensive forests of the county support a diverse wood-using industry ranging from small sawmills to large paper mills.

Most of the privately owned forest is in need of more intensive management. Probably the greatest need is for removal of defective trees and trees of inferior species.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

*Erosion hazard* is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

*Equipment limitation* reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

*Seedling mortality* refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for

seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

*Windthrow hazard* is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

*Trees to plant* are those that are suitable for commercial wood production.

Additional information about woodland management and productivity can be obtained from the Wisconsin Department of Natural Resources or the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

## Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the Natural Resources Conservation Service, the Cooperative Extension Service, the Wisconsin Department of Natural Resources, or from a commercial nursery.

## Recreation

Marathon County offers many year-round recreation opportunities. Rib Mountain State Park, 23 county parks, about 25,000 acres of county forest land, and about 23,000 acres of state public hunting and fishing land are available for public recreational use. These areas are used for skiing, camping, hiking, fishing, hunting, sightseeing, picnicking, swimming, and boating. Water-related activities, such as fishing, boating, and swimming, also are available on several lakes in the southeastern part of the county and on rivers, such as the Big Rib, Little Rib, Big Eau Pleine, Plover, and Wisconsin Rivers.

Use of recreation facilities has increased greatly in the past several years in Marathon County. Many soils

are suited to the development of recreation facilities. Soils that are best suited are in associations 3, 5, and 8, which are described under the heading "General Soil Map Units." These associations are characterized by hilly terrain, wooded slopes, exposed rock formations, and lakes and streams that provide a variety of recreation opportunities.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

*Camp areas* require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

*Playgrounds* require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

*Paths and trails* for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

## Wildlife Habitat

Thomas P. Thrall, biologist, Natural Resources Conservation Service, helped prepare this section.

Wildlife habitat is closely related to soils because soils have a great influence on the kind of vegetation that grows in an area as well as on land use. Generally speaking, the more diverse the soils are the more diverse the wildlife species. Marathon County has diverse soils and land uses; therefore, there is a varied wildlife community.

In the paragraphs that follow, the associations described under the heading "General Soil Map Units" are related to wildlife habitat and species. Although there are no clear-cut boundaries for wildlife, these associations can generally be described in terms of the wildlife they produce.

*Association 1.*—This area consists mainly of large tracts of northern hardwoods, particularly in the northwestern part of the county. The balance of the area is in farms and is characterized by smaller areas of woodland. Representative wildlife species are white-tailed deer, black bear, porcupine, squirrel, and bobcat.

*Association 2.*—This area is predominantly cropland with tracts of northern red oak, sugar maple, and white ash. Many of the woodlots are pastured. As a result, their value as wildlife habitat is reduced. Wildlife species are those typical of agricultural areas. They include red fox, cottontail rabbit, raccoon, skunk, and woodchuck.

*Association 3.*—This area has diverse types of habitat. There are some large blocks of northern hardwoods and scattered areas of aspen. Many small crop fields add edge effect and diversity to the habitat. Many scattered areas of cedar bogs as well as some open pothole areas are used by mallards and wood ducks. This is a prime area for deer, ruffed grouse, snowshoe hare, and gray squirrel.

*Association 4.*—This area includes some large tracts of hardwoods as well as cropland. There is a fair amount of aspen, which is important to deer and ruffed grouse. Major wildlife species include the white-tailed deer, ruffed grouse, gray squirrel, and fox squirrel.

*Association 5.*—The habitat and wildlife in this area are similar to those in association 2. Because of the steepness of woodlots, pasturing is not so heavy in this area. As a result, this area tends to provide better wildlife habitat than does association 2. The southern part of this area includes the Big Eau Pleine reservoir, which is an important area for geese, ducks, and other waterfowl, including the double-crested cormorant, bald eagles, and ospreys, which are endangered species.

*Association 6.*—This area includes many tracts of hardwoods, paper birch, and aspen. Some areas are farmed, and many areas formerly were farmed but have reverted to grassland. These idle grasslands provide nesting cover for birds as well as hunting areas for bird and mammal predators.

*Association 7.*—This area includes wooded flood plains that commonly support silver maple, ash, willows, red maple, and alder. The area provides habitat for mink, muskrat, gray fox, deer, beaver, otter, and wood ducks. Bald eagles, ospreys, and cormorants also use the area. Some pine and scrub oak grow on sandy uplands in this area. These uplands are important areas for some nongame bird species.

*Association 8.*—The more steeply sloping areas of this association support many hardwood forests. Much of the more nearly level land is used for crops. This area includes the Plover River, which is extensively used for duck hunting. There are several trout streams in this area. The riparian habitat along the streams supports many furbearer species. Other species in this association are similar to those in association 3.

*Association 9.*—This area includes many tracts of pine and northern hardwoods. Much of the more nearly level land is cropped. This area provides good habitat for deer, ruffed grouse, woodcock, sandhill cranes, snowshoe hare, and gray squirrel. It includes the Plover River and numerous small lakes and ponds, which provide habitat for waterfowl and many furbearers.

*Association 10.*—This is a very important wildlife area. It includes many cedar bogs, which provide valuable habitat for deer, snowshoe hare, and many other wildlife species. The major deer yards in the county are in this association. This association is an important part of the Mead and McMillan Wildlife Areas, which are two of the state's most important wildlife areas. These wildlife areas provide habitat for waterfowl, furbearers, deer, prairie chicken, sharp-tailed grouse, double-crested cormorants, sandhill cranes, and many other unique wildlife species.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

*Grain and seed crops* are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are timothy, bromegrass, clover, and alfalfa.

*Wild herbaceous plants* are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are curly dock, goldenrod, smartweed, and ragweed.

*Hardwood trees* and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are dogwood, highbush cranberry, and crabapple.

*Coniferous plants* furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

*Shallow water areas* have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl-feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

*Habitat for openland wildlife* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include red-tailed hawk, bobolink, meadowlark, field sparrow, sandhill crane, cottontail, and red fox.

*Habitat for woodland wildlife* consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

*Habitat for wetland wildlife* consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

## Engineering

Michael J. Tiry, civil engineer, Natural Resources Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

*Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.*

*The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.*

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

### Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

*Shallow excavations* are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

*Dwellings* and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

*Local roads and streets* have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

*Lawns and landscaping* require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil

properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

**Sanitary Facilities**

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

*Septic tank absorption fields* are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

*Sewage lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

*Sanitary landfills* are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

*Daily cover for landfill* is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

**Construction Materials**

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

*Roadfill* is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

*Sand and gravel* are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

*Topsoil* is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by

slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

**Water Management**

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

*Embankments, dikes, and levees* are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts. A high water table affects the amount of usable material. It also affects trafficability.

*Drainage* is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement, permeability, depth to a high water table or depth of standing water if the soil is subject to ponding, slope, susceptibility to flooding, subsidence of organic layers, and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts. Availability of drainage outlets is not considered in the ratings.

*Irrigation* is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts, and soil reaction.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to reduce water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

*Grassed waterways* are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

# Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

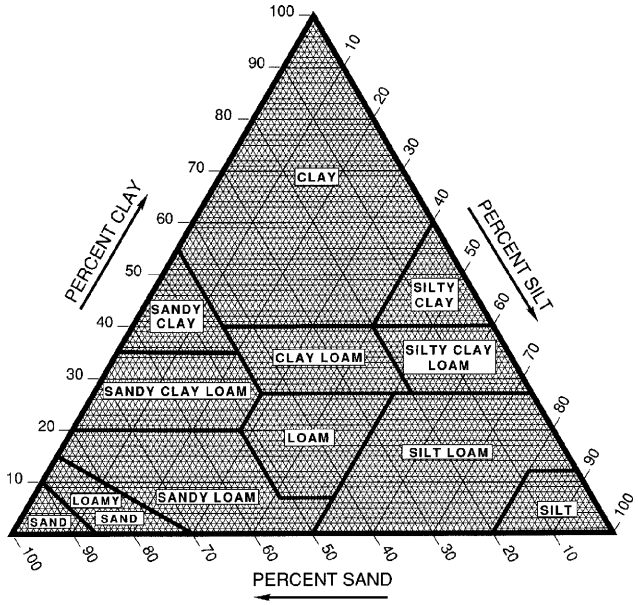


**Figure 6.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.**

## Engineering Index Properties

Michael J. Tiry, civil engineer, Natural Resources Conservation Service, helped prepare this section.

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

*Depth* to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 6). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

*Classification* of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and

OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

*Rock fragments* larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

*Percentage (of soil particles) passing designated sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

*Liquid limit* and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

## Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Clay* as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

*Moist bulk density* is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

*Permeability* refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

*Available water capacity* refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

*Soil reaction* is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory

analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

*Shrink-swell potential* is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

*Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor T* is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control 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. 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. Crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

## Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

*Flooding*, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*High water table* (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

*Depth to bedrock* is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

*Subsidence* is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 17 shows the expected total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

*Potential frost action* is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on

thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

*Risk of corrosion* pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

## Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section “Soil Series and Their Morphology.” The soil samples were tested by the Wisconsin Department of Transportation, Division of Highways and Transportation Facilities.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

# Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(15)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boralf (*Bor*, meaning cool, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Glossoboralfs (*Gloss*, meaning tongued, plus *boralf*, the suborder of the Alfisols that has a cool temperature regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Glossoboralfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed Typic Glossoboralfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

## Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (14)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (15)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section “Detailed Soil Map Units.”

### Alban Series

The Alban series consists of deep, moderately well drained, moderately permeable soils on glacial lake

plains, delta kames, and stream terraces. These soils formed in loamy lacustrine deposits over stratified sandy and loamy deposits. Slope ranges from 1 to 6 percent.

Typical pedon of Alban loam, 1 to 6 percent slopes, 1,750 feet east and 700 feet south of the northwest corner of sec. 35, T. 29 N., R. 10 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.
E—7 to 11 inches; brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry; moderate thin platy structure; friable; common fine roots; slightly acid; clear wavy boundary.
E/B—11 to 22 inches; 70 percent brown (10YR 5/3) loam (E), very pale brown (10YR 7/3) dry; weak thin platy structure; friable; remnants of dark brown (7.5YR 4/4) fine sandy loam (Bt); weak very fine subangular blocky structure; friable; few fine roots; slightly acid; gradual wavy boundary.
B/E—22 to 34 inches; 70 percent dark brown (7.5YR 4/4) fine sandy loam (Bt); moderate fine subangular blocky structure; friable; few fine roots; tongues of brown (10YR 5/3) sandy loam (E); few faint clay films on faces of peds (Bt); slightly acid; clear wavy boundary.
Bt—34 to 38 inches; dark brown (7.5YR 4/4) fine sandy loam; common fine distinct strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; very friable; few fine roots; common clay coatings on sand grains; medium acid; clear wavy boundary.
C—38 to 60 inches; brown (7.5YR 5/4) fine sand; common fine distinct strong brown (7.5YR 5/8) mottles; single grain; loose; strata of dark brown (7.5YR 4/4) loamy fine sand 4 to 5 inches apart and 0.25 to 1 inch thick; massive; very friable; few fine roots; slightly acid.

The thickness of the solum ranges from 27 to 45 inches. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is sandy loam, fine sandy loam, loam, or silt loam. The Bt horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 to 6. This horizon has mottles with chroma of 6 to 8. It is sandy loam, fine sandy loam, or loam. The C horizon is stratified with sand, fine sand, loamy sand, loamy fine sand, very fine sandy loam, loam, silt loam, or silt.

## Altdorf Series

The Altdorf series consists of deep, poorly drained, slowly permeable soils on ground moraines. These soils formed in silty deposits underlain by clayey and loamy glacial till or in residuum derived from metamorphic rock, or in both. Slope ranges from 0 to 2 percent.

Typical pedon of Altdorf mucky silt loam, 0 to 2 percent slopes, 2,450 feet south and 2,400 feet east of the northwest corner of sec. 21, T. 28 N., R. 9 E.

Oi—1 inch to 0; litter layer of dead roots, leaves, and twigs.
A—0 to 3 inches; black (10YR 2/1) mucky silt loam, very dark gray (10YR 3/1) dry; moderate very fine subangular blocky structure; friable; common fine roots; about 3 percent gravel; about 20 percent organic matter; strongly acid; abrupt wavy boundary.
Eg—3 to 8 inches; dark gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium platy structure parting to moderate very fine subangular blocky; friable; about 3 percent gravel; strongly acid; clear wavy boundary.
B/Eg—8 to 12 inches; 60 percent dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; tongues of dark gray (10YR 4/1) silt loam (E); few fine roots; few distinct very dark gray (10YR 3/1) clay films on faces of Bt peds and in tubular pores; strongly acid; clear wavy boundary.
2Bt1—12 to 16 inches; reddish brown (5YR 4/4) clay; common medium distinct yellowish red (5YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct dark gray (10YR 4/1) clay films on faces of peds and in tubular pores; medium acid; clear wavy boundary.
2Bt2—16 to 28 inches; reddish brown (5YR 4/4) clay; few medium distinct yellowish red (5YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; few distinct reddish gray (5YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.
2Bt3—28 to 44 inches; reddish brown (5YR 5/4) and dark red (2.5YR 3/6) clay; weak medium prismatic structure parting to weak medium subangular blocky; firm; few distinct dark reddish brown (2.5YR 3/4) clay films on faces of peds; neutral; clear wavy boundary.

2C—44 to 60 inches; yellow (2.5Y 7/8), dark reddish brown (5YR 3/4), and dusky red (2.5YR 3/2) clay loam; massive; firm; neutral.

The thickness of the solum ranges from 41 to 50 inches. The thickness of the silty deposits ranges from 7 to 15 inches. The content of gravel in the solum and the substratum ranges from 0 to 5 percent.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Eg horizon has hue of 10YR or 2.5Y and value of 4 to 6. The 2Bt horizon has hue of 5YR, 2.5YR, or 10R; value of 3 to 5; and chroma of 3 to 6. It is clay or clay loam. The 2C horizon is dominantly clay loam or clay. Some pedons have thin strata of loam, sandy loam, or sandy clay loam in the 2C horizon.

## Amery Series

The Amery series consists of deep, well drained soils on ground moraines. These soils formed in silty and loamy deposits and in the underlying loamy and sandy glacial till. Permeability is moderately slow in the subsoil and extremely slow to slow in the substratum. Slope ranges from 5 to 15 percent.

Typical pedon of Amery silt loam, 5 to 15 percent slopes, 750 feet south and 250 feet east of the center of sec. 4, T. 30 N., R. 7 E.

A—0 to 4 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine roots; about 4 percent gravel; slightly acid; abrupt wavy boundary.

Bs—4 to 8 inches; dark brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable; many fine roots; about 6 percent gravel; medium acid; clear wavy boundary.

E/B—8 to 16 inches; 65 percent brown (10YR 5/3) loam (E), very pale brown (10YR 7/3) dry; weak thin platy structure; friable; dark brown (7.5YR 4/4) loam (Bt); moderate very fine subangular blocky structure; friable; few fine roots; about 6 percent gravel and 2 percent cobbles; medium acid; gradual wavy boundary.

B/E—16 to 24 inches; 80 percent dark brown (7.5YR 4/4) fine sandy loam (Bt); moderate fine subangular blocky structure; friable; tongues of brown (10YR 5/3) fine sandy loam (E); few fine roots; few clay coatings on sand grains of Bt peds; about 10 percent gravel and 2 percent cobbles; strongly acid; gradual wavy boundary.

Bt—24 to 34 inches; dark reddish brown (5YR 3/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common clay coatings on sand grains; about 10 percent gravel and 3 percent cobbles; strongly acid; gradual wavy boundary.

C—34 to 60 inches; reddish brown (5YR 4/4) gravelly sandy loam; massive; friable; about 15 percent gravel and 5 percent cobbles; medium acid.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the silty deposits ranges from 5 to 15 inches. The content of gravel ranges from 0 to 15 percent in the silty deposits and from 10 to 35 percent in the glacial till. The content of cobbles and stones ranges from 0 to 3 percent in the silty deposits and from 2 to 10 percent in the glacial till.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Ap horizon, where it occurs, has value and chroma of 2 or 3. The Bt horizon has value and chroma of 3 to 6. It is fine sandy loam, sandy loam, or gravelly sandy loam. The C horizon is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam.

## Cable Series

The Cable series consists of deep, poorly drained and very poorly drained soils on ground moraines. These soils formed in silty deposits and in the underlying loamy glacial till. Permeability is moderate or moderately slow in the subsoil and moderately slow in the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Cable silt loam, 0 to 3 percent slopes, stony, 1,600 feet south and 500 feet west of the northeast corner of sec. 8, T. 30 N., R. 9 E.

Oa—0 to 3 inches; sapric material, very dark brown (10YR 2/2) unrubbed, black (10YR 2/1) rubbed; about 25 percent fiber, 8 percent rubbed; moderate fine granular structure; nonsticky; many fine roots; very strongly acid; clear wavy boundary.

A—3 to 6 inches; very dark brown (10YR 2/2) silt loam; weak fine subangular blocky structure; friable; about 15 percent organic matter; about 10 percent gravel and 4 percent cobbles; common fine roots; very strongly acid; clear wavy boundary.

Eg—6 to 10 inches; dark gray (10YR 4/1) silt loam; few medium distinct dark yellowish brown (10YR 4/4) mottles; moderate thick platy structure parting to moderate fine subangular blocky; friable; about 10 percent gravel and 4 percent cobbles; few fine roots; very strongly acid; clear wavy boundary.

Bg1—10 to 20 inches; grayish brown (10YR 5/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; about 10 percent gravel;

few fine roots; medium acid; clear wavy boundary.
2Bg2—20 to 30 inches; grayish brown (10YR 5/2) loam; many medium prominent strong brown (7.5YR 5/8) mottles; moderate coarse subangular blocky structure; friable; about 13 percent gravel; few fine roots; strongly acid; clear wavy boundary.
2C—30 to 60 inches; reddish brown (5YR 4/4) gravelly sandy loam; few medium distinct yellowish red (5YR 5/6) mottles; massive; friable; about 15 percent gravel and 5 percent cobbles; slightly acid.

The thickness of the solum ranges from 27 to 40 inches. The thickness of the silty deposits ranges from 15 to 30 inches. The content of gravel ranges from 0 to 15 percent in the silty upper part of the solum and from 10 to 25 percent in the loamy lower part and in the substratum. The content of cobbles and stones ranges from 15 to 35 percent in the upper part of the solum and from 0 to 15 percent in the lower part and in the substratum.

The Oa horizon is 0 to 6 inches thick. The A horizon or the Ap horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is silt loam, loam, or fine sandy loam. The 2Bg horizon has colors similar to those of the Bg horizon. It is sandy loam, gravelly sandy loam, loam, or gravelly loam. The 2C horizon is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand.

## Cathro Series

The Cathro series consists of deep, very poorly drained soils in depressions and drainageways on ground moraines, glacial lake plains, and outwash plains. These soils formed in 16 to 51 inches of herbaceous organic material and are underlain by loamy and silty deposits. Permeability is moderately slow to moderately rapid in the organic material and moderately slow or moderate in the loamy and silty deposits. Slope is 0 to 1 percent.

Typical pedon of Cathro muck, 0 to 1 percent slopes, 1,875 feet north and 50 feet east of the southwest corner of sec. 5, T. 29 N., R. 3 E.

Oe—0 to 5 inches; hemic material, dark reddish brown (5YR 3/2) broken face, dark brown (7.5YR 3/2) rubbed; about 50 percent fiber, 15 percent rubbed; weak thick platy structure; nonsticky; herbaceous fibers; common roots; medium acid (pH 5.6 in water); clear wavy boundary.
Oa1—5 to 14 inches; sapric material, black (10YR 2/1) broken face, black (5YR 2/1) rubbed; about 10 percent fiber, 2 percent rubbed; moderate coarse subangular blocky structure; slightly sticky; herbaceous fibers; few roots; medium acid (pH 5.6 in water); clear wavy boundary.
Oa2—14 to 21 inches; sapric material, dark reddish brown (5YR 3/2) broken face and rubbed; about 10 percent fiber, 2 percent rubbed; moderate thick platy structure; nonsticky; herbaceous fibers; few roots; medium acid (pH 5.7 in water); clear wavy boundary.
Oa3—21 to 28 inches; sapric material, black (5YR 2/1) broken face and rubbed; about 10 percent fiber, 2 percent rubbed; moderate medium subangular blocky structure; nonsticky; herbaceous fibers; medium acid (pH 5.7 in water); abrupt wavy boundary.
C1—28 to 33 inches; dark gray (10YR 4/1) silt loam; weak coarse subangular blocky structure; friable; about 10 percent sapric material; medium acid; clear wavy boundary.
C2—33 to 60 inches; gray (5Y 5/1) loam; common medium prominent yellowish brown (10YR 5/8) and few medium prominent strong brown (7.5YR 5/8) mottles; massive; firm; medium acid.

The thickness of the organic material ranges from 16 to 51 inches. The surface, subsurface, and bottom tiers have hue of 10YR, 7.5YR, or 5YR or are neutral in hue. They have chroma of 0 to 3. Some pedons have 5 to 15 percent, by volume, woody fragments mixed throughout the organic material. The C horizon is silt loam, loam, sandy loam, clay loam, or sandy clay loam.

## Chetek Series

The Chetek series consists of deep, somewhat excessively drained soils on glacial outwash plains and stream terraces. These soils formed in loamy deposits and in the underlying sand and gravel. Permeability is moderate to rapid in the upper part of the profile and rapid in the lower part. Slope ranges from 0 to 30 percent.

Typical pedon of Chetek sandy loam, 2 to 6 percent slopes, 500 feet north and 650 feet west of the southeast corner of sec. 15, T. 28 N., R. 8 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, pale brown (10YR 6/3) dry; moderate fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.
E—8 to 13 inches; brown (10YR 4/3) sandy loam, very pale brown (10YR 7/3) dry; weak medium platy structure parting to moderate very fine subangular blocky; friable; few fine roots; slightly acid; clear wavy boundary.

Bt1—13 to 19 inches; dark brown (7.5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; common clay coatings on sand grains; few fine roots; about 12 percent gravel; slightly acid; clear wavy boundary.
2Bt2—19 to 23 inches; brown (7.5YR 5/4) gravelly loamy sand; weak coarse subangular blocky structure; very friable; few clay bridges between sand grains; few fine roots; about 22 percent gravel; medium acid; clear wavy boundary.
2C—23 to 60 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 15 percent gravel and 4 percent cobbles; slightly acid.

The thickness of the solum ranges from 16 to 24 inches. The content of gravel in the upper part of the solum ranges from 0 to 15 percent. The content of gravel in the lower part of the subsoil and in the substratum ranges from 15 to 35 percent. The content of cobbles ranges from 0 to 10 percent throughout the pedon.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The A horizon, where it occurs, has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The Bt horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4. It is sandy loam or loam. The 2Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 or 5. It is gravelly loamy sand or gravelly sandy loam. The 2C horizon is gravelly coarse sand or sand and gravel. Stratification of these materials is common.

## Dancy Series

The Dancy series consists of deep, poorly drained soils in drainageways and depressions on ground moraines. These soils formed in sandy loam and loamy sand deposits underlain by loamy glacial till or in loamy residuum derived from igneous and metamorphic rock, or in both. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Dancy sandy loam, 0 to 2 percent slopes, 550 feet west and 100 feet south of the northeast corner of sec. 31, T. 28 N., R. 9 E.

A—0 to 4 inches; black (10YR 2/1) sandy loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; very friable; few fine roots; about 3 percent gravel; medium acid; abrupt wavy boundary.
E—4 to 10 inches; gray (10YR 5/1) loamy sand; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; few fine roots; about 3 percent gravel; medium acid; clear wavy boundary.
E/B—10 to 21 inches; 80 percent gray (10YR 5/1) loamy sand (E); many medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; isolated remnants of brown (10YR 4/3) sandy loam (Bt); about 5 percent gravel; medium acid; clear wavy boundary.
2Btg—21 to 30 inches; light brownish gray (2.5Y 6/2) loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common faint patchy grayish brown (2.5Y 5/2) clay films on faces of peds; about 8 percent gravel; medium acid; clear wavy boundary.
2BCg—30 to 41 inches; dark grayish brown (2.5Y 4/2) loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; about 12 percent gravel; medium acid; gradual wavy boundary.
2Cg—41 to 60 inches; dark grayish brown (2.5Y 4/2), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6) sandy loam; massive; friable; about 12 percent gravel; slightly acid.

The thickness of the solum ranges from 35 to 48 inches. The thickness of the loamy sand and sandy loam deposits ranges from 20 to 40 inches. The content of gravel ranges from 0 to 10 percent in the upper part and from 0 to 30 percent in the lower part and in the substratum. The content of cobbles and stones ranges from 0 to 10 percent in the solum and substratum.

The A horizon or the Ap horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The 2Btg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is sandy loam, loam, sandy clay loam, clay loam, or the gravelly analogs of these textures. The 2Cg horizon has textures similar to those of the 2Btg horizon.

## Dolph Series

The Dolph series consists of deep, somewhat poorly drained, slowly permeable soils on ground moraines. These soils formed in silty deposits underlain by clayey and loamy glacial till or in residuum derived from metamorphic rock, or in both. Slope ranges from 0 to 3 percent.

Typical pedon of Dolph silt loam, 0 to 3 percent slopes, 1,350 feet west and 450 feet north of the center of sec. 28, T. 28 N., R. 9 E.

Oi—1 inch to 0; litter layer of leaves, twigs, and grasses.

A—0 to 3 inches; black (10YR 2/1) silt loam; strong fine and very fine granular structure; very friable; common fine roots; strongly acid; abrupt smooth boundary.
E—3 to 6 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; common fine faint grayish brown (10YR 5/2) and common fine prominent strong brown (7.5YR 5/8) mottles; weak medium platy structure parting to moderate very fine subangular blocky; very friable; common fine roots; strongly acid; clear wavy boundary.
E/B—6 to 9 inches; 70 percent brown (10YR 4/3) silt loam (E), light brownish gray (10YR 6/2) dry; common fine faint grayish brown (10YR 5/2) and common fine prominent strong brown (7.5YR 5/8) mottles; weak medium platy structure parting to moderate very fine subangular blocky; friable; isolated remnants of dark brown (7.5YR 4/4) silt loam (Bt); common fine roots; strongly acid; clear wavy boundary.
B/E—9 to 15 inches; 80 percent reddish brown (5YR 4/3) silty clay loam (Bt); common fine distinct brown (7.5YR 5/2) and common medium prominent strong brown (7.5YR 5/8) mottles; strong fine angular blocky structure; firm; tongues of brown (7.5YR 5/4) silt loam (E), pink (7.5YR 7/4) dry; few fine roots; common faint dark reddish gray (5YR 4/2) continuous clay films on faces of Bt peds; strongly acid; clear wavy boundary.
2Bt1—15 to 25 inches; dark red (2.5YR 3/6) clay; common medium distinct red (2.5YR 4/8) mottles; moderate fine subangular blocky structure; firm; few fine roots; common distinct dusky red (2.5YR 3/2) continuous clay films in pores; strongly acid; clear wavy boundary.
2Bt2—25 to 37 inches; dark reddish brown (2.5YR 3/4) clay; common medium distinct red (2.5YR 4/8) mottles; moderate fine subangular blocky structure; firm; few fine roots; common distinct dusky red (2.5YR 3/2) continuous clay films in pores; strongly acid; clear wavy boundary.
2C—37 to 60 inches; dark reddish brown (2.5YR 3/4) clay loam; few fine prominent red (2.5YR 4/8) mottles; massive; firm; few fine roots; about 5 percent gravel; slightly acid.

The thickness of the solum ranges from 24 to 45 inches. The thickness of the silty deposits ranges from 9 to 16 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Ap horizon, where it occurs, has value of 3 or 4 and chroma of 2. The 2Bt horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 3 to 6. It is clay loam or clay. The 2C horizon is sandy clay loam or clay loam.

## Dunnville Series

The Dunnville series consists of deep, moderately well drained soils on low stream terraces along large rivers. These soils formed in loamy and sandy alluvial deposits. Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. Slope ranges from 1 to 4 percent.

Typical pedon of Dunnville fine sandy loam, 1 to 4 percent slopes, 1,000 feet north of the center of sec. 2, T. 28 N., R. 7 E.

Ap—0 to 8 inches; dark brown (7.5YR 3/2) fine sandy loam, brown (10YR 4/3) dry; moderate fine granular structure; friable; common fine roots; strongly acid; abrupt smooth boundary.
Bw1—8 to 16 inches; dark reddish brown (5YR 3/3) fine sandy loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; friable; few fine roots; medium acid; gradual wavy boundary.
Bw2—16 to 26 inches; dark reddish brown (5YR 3/4) fine sandy loam; weak fine subangular blocky structure; friable; few fine roots; medium acid; clear wavy boundary.
BC—26 to 36 inches; reddish brown (5YR 4/4) loamy fine sand; weak medium subangular blocky structure; very friable; few fine roots; medium acid; clear wavy boundary.
2C1—36 to 44 inches; yellowish brown (10YR 5/4) fine sand; common medium prominent strong brown (7.5YR 5/8) mottles; single grain; loose; medium acid; clear wavy boundary.
2C2—44 to 60 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 20 percent gravel; slightly acid.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel ranges from 0 to 5 percent in the solum and from 0 to 35 percent in the substratum.

The Ap horizon or the A horizon, where it occurs, has hue of 10YR or 7.5YR and value and chroma of 2 or 3. The Bw horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 3 to 6. It is loam, fine sandy loam, or sandy loam. The 2C horizon is sand, fine sand, or gravelly sand.

## Fenwood Series

The Fenwood series consists of deep, well drained, moderately permeable soils on uplands underlain by bedrock. These soils formed in silty deposits underlain by loamy glacial till or in loamy residuum derived from the underlying bedrock, or in both. They are underlain

by igneous and metamorphic rock. Slope ranges from 2 to 30 percent.

Typical pedon of Fenwood silt loam, in an area of Fenwood-Rozellville silt loams, 2 to 6 percent slopes; 125 feet west and 1,780 feet north of the southeast corner of sec. 28, T. 29 N., R. 6 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine and very fine subangular blocky structure; friable; many fine roots; about 3 percent angular gravel; strongly acid; abrupt smooth boundary.

E—8 to 12 inches; grayish brown (10YR 5/2) and brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry; weak medium platy structure parting to weak very fine subangular blocky; friable; common fine fibrous roots; about 3 percent angular gravel; strongly acid; clear wavy boundary.

E/B—12 to 18 inches; 60 percent brown (10YR 5/3) loam (E), very pale brown (10YR 7/3) dry; weak thin platy structure; friable; remnants of dark yellowish brown (10YR 4/4) loam (Bt); weak fine subangular blocky structure; friable; common fine fibrous roots; few faint clay films on faces of peds and in pores; about 7 percent angular gravel; strongly acid; clear wavy boundary.

B/E—18 to 24 inches; 70 percent dark brown (7.5YR 4/4) loam (Bt); moderate medium subangular blocky structure; firm; many faint clay films on faces of peds and in tubular pores; tongues of brown (10YR 5/3) loam (E); weak thin platy structure; friable; about 7 percent angular gravel; extremely acid; clear wavy boundary.

Bt1—24 to 31 inches; dark brown (7.5YR 4/4) gravelly loam; moderate medium angular and subangular blocky structure; very firm; few fine fibrous roots; many faint clay films on faces of peds and in tubular pores; about 15 percent angular gravel; extremely acid; clear wavy boundary.

Bt2—31 to 43 inches; dark brown (7.5YR 4/4) cobbly loam; moderate medium angular blocky structure; very firm; common continuous faint clay films on faces of most peds and in tubular pores; about 20 percent angular gravel and 15 percent angular cobbles; extremely acid; gradual irregular boundary.

R—43 inches; shattered igneous and metamorphic rock with dark brown (7.5YR 4/4) loam in joints that diminish with depth.

The thickness of the solum ranges from 36 to 48 inches. The thickness of the silty deposits ranges from 7 to 15 inches. The depth to bedrock ranges from 40 to 60 inches. The content of gravel ranges from 0 to 10 percent in the surface horizon, from 5 to 15 percent in the upper part of the subsoil, and from 15 to 35 percent in the lower part of the subsoil. The content of cobbles ranges from 0 to 15 percent in the upper part of the solum and from 5 to 35 percent in the lower part and in the substratum. The content of cobbles and stones in the surface horizon of the stony phases is 15 to 35 percent.

The Ap horizon or the A horizon, where it occurs, has value and chroma of 2 or 3. The Bt1 horizon has hue of 7.5YR or 10YR and value and chroma of 4 or 5. It is loam, sandy clay loam, or clay loam. The Bt2 horizon has colors similar to those of the Bt1 horizon. It is gravelly, cobbly, or very cobbly loam; gravelly or cobbly sandy clay loam; or gravelly or cobbly clay loam. The BC and C horizons, where they occur, are cobbly or very cobbly sandy loam or cobbly or very cobbly loam.

## Fordum Series

The Fordum series consists of deep, poorly drained and very poorly drained soils on flood plains. These soils formed in alluvial deposits. Permeability is moderate or moderately rapid in the upper part of the profile and rapid in the lower part. Slope is 0 to 1 percent.

Typical pedon of Fordum silt loam, 0 to 1 percent slopes, 125 feet west and 500 feet south of the center of sec. 33, T. 29 N., R. 7 E.

A—0 to 6 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; many fine and medium roots; neutral; abrupt wavy boundary.

Cg1—6 to 18 inches; dark gray (5Y 4/1) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; many thin strata of fine sandy loam; medium acid; clear wavy boundary.

Cg2—18 to 30 inches; dark gray (10YR 4/1) fine sandy loam; common fine prominent strong brown (7.5YR 5/6) mottles; massive; friable; many thin strata of silt loam and fine sand; medium acid; clear wavy boundary.

Cg3—30 to 60 inches; gray (10YR 5/1) sand; single grain; loose; few thin strata of silt loam; slightly acid.

The thickness of the solum ranges from 6 to 9 inches. The depth to sand or sand mixed with gravel ranges from 24 to 40 inches. The content of gravel ranges from 0 to 20 percent throughout the profile.

The A horizon has hue of 5Y, 2.5Y, 10YR, or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma

of 0 to 3. The Oa horizon, where it occurs, is as much as 6 inches thick. The Cg1 and Cg2 horizons are commonly stratified silt loam, loam, sandy loam, or fine sandy loam, but in some pedons they have thin strata of very fine sand, fine sand, or the mucky analogs of these textures. The Cg3 horizon is sand, fine sand, loamy sand, loamy fine sand, or the gravelly analogs of these textures.

## Freeon Series

The Freeon series consists of deep, moderately well drained soils on ground moraines. These soils formed in silty deposits and in the underlying loamy glacial till. Permeability is moderate in the silty upper part of the subsoil and very slow in the substratum. Slope ranges from 6 to 12 percent.

Typical pedon of Freeon silt loam, 6 to 12 percent slopes, 2,650 feet south and 400 feet west of the northeast corner of sec. 6, T. 29 N., R. 4 E.

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; friable; common fine roots; about 6 percent gravel; strongly acid; abrupt smooth boundary.

E/B—9 to 16 inches; 70 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; remnants of dark yellowish brown (10YR 4/4) silt loam (B); weak medium platy structure parting to moderate very fine subangular blocky; friable; few fine roots; about 8 percent gravel; strongly acid; gradual wavy boundary.

B/E—16 to 21 inches; 70 percent dark yellowish brown (10YR 4/4) silt loam (B); common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; few faint dark brown (7.5YR 4/4) clay films on horizontal faces of peds; tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; about 5 percent gravel; very strongly acid; clear wavy boundary.

2Bt1—21 to 28 inches; reddish brown (5YR 4/4) loam; common medium distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common distinct strong brown (7.5YR 4/6) clay films on all faces of peds; few fine distinct brown (7.5YR 5/2) mottles in root channels; fingers of brown (10YR 5/3) E horizon material extend into the upper part of the horizon; about 14 percent gravel; very strongly acid; clear wavy boundary.

2Bt2—28 to 31 inches; reddish brown (5YR 4/4) gravelly loam; few fine distinct yellowish red (5YR 5/6) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; firm; common faint dark reddish brown (5YR 3/4) clay films on vertical faces of peds; about 16 percent gravel; very strongly acid; clear wavy boundary.

2Bt3—31 to 35 inches; reddish brown (5YR 4/4) gravelly sandy loam; few fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; firm; a few clay coatings on sand grains; about 30 percent gravel and 3 percent cobbles; strongly acid; gradual wavy boundary.

2Cd—35 to 60 inches; yellowish red (5YR 4/6) gravelly sandy loam; massive; firm; about 25 percent gravel and 3 percent cobbles; strongly acid.

The thickness of the solum ranges from 30 to 45 inches. The thickness of the silty deposits ranges from 15 to 30 inches. The content of gravel ranges from 0 to 5 percent in the silty upper part of the solum and from 5 to 20 percent in the loamy lower part and in the substratum. The content of cobbles ranges from 0 to 10 percent in the lower part of the solum and in the substratum.

The Ap horizon has value and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The 2Bt horizon has hue of 7.5YR, 5YR, or 2.5YR and value and chroma of 3 or 4. This horizon has mottles with chroma of 6 to 8. It is loam, gravelly loam, sandy loam, or gravelly sandy loam. The 2Cd horizon is typically sandy loam or gravelly sandy loam, but some pedons have pockets of loamy sand, fine sandy loam, loam, clay loam, or the gravelly analogs of these textures.

## Graycalm Series

The Graycalm series consists of deep, somewhat excessively drained and moderately well drained, rapidly permeable soils on recessional moraines, glacial lake plains, and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 6 percent.

Typical pedon of Graycalm loamy sand, 2 to 6 percent slopes, 1,950 feet east and 25 feet north of the southwest corner of sec. 26, T. 27 N., R. 9 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

Bw1—9 to 18 inches; dark brown (7.5YR 4/4) loamy sand; weak very fine subangular blocky structure; very friable; few fine roots; mildly alkaline; clear wavy boundary.

Bw2—18 to 26 inches; strong brown (7.5YR 5/6) loamy sand; weak very fine subangular blocky

structure; very friable; few fine roots; medium acid; clear wavy boundary.

E&Bt—26 to 52 inches; yellowish brown (10YR 5/4) loamy sand (E); single grain; loose; lamellae of brown (7.5YR 4/4) fine sandy loam (Bt); weak fine subangular blocky structure; friable; few fine roots; wavy and discontinuous lamellae spaced 1/2 inch to 3 inches apart and 1/8 to 1/2 inch thick; medium acid; abrupt wavy boundary.

C—52 to 60 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; medium acid.

The thickness of the solum ranges from 40 to 54 inches. The content of gravel ranges from 0 to 15 percent in the solum and the substratum.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The A horizon, where it occurs, has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The Bw horizon has hue of 10YR or 7.5YR. It is loamy sand or sand. The E part of E&Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is sand, loamy sand, fine sand, or loamy fine sand. The Bt part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand, sandy loam, or fine sandy loam. In some pedons it has mottles with high chroma below a depth of 30 inches.

## Greenwood Series

The Greenwood series consists of deep, very poorly drained, moderately or moderately rapidly permeable soils in depressions on ground moraines, outwash plains, and glacial lake plains. These soils formed in herbaceous organic material more than 51 inches thick. Slope is 0 to 1 percent.

Typical pedon of Greenwood peat, 0 to 1 percent slopes, 1,000 feet east and 300 feet north of the center of sec. 13, T. 28 N., R. 10 E.

Oi—0 to 4 inches; fibric material, very dark grayish brown (2.5Y 3/2) broken face, dark brown (7.5YR 3/2) rubbed; about 95 percent fiber, 75 percent rubbed; moderate thin platy structure; nonsticky; common roots; primarily sphagnum moss; very strongly acid (pH 4.4 in water); clear wavy boundary.

Oe1—4 to 13 inches; hemic material, very dark brown (10YR 2/2) broken face and rubbed; about 50 percent fiber, 20 percent rubbed; moderate very thin platy structure; slightly sticky; common roots; primarily herbaceous fibers; very strongly acid (pH 4.4 in water); gradual wavy boundary.

Oe2—13 to 20 inches; hemic material, dark reddish brown (5YR 2/2) broken face and rubbed; about 50 percent fiber, 20 percent rubbed; moderate medium platy structure; slightly sticky; few roots; primarily herbaceous fibers; very strongly acid (pH 4.4 in water); gradual wavy boundary.

Oe3—20 to 29 inches; hemic material, dark reddish brown (5YR 2/2) broken face and rubbed; about 75 percent fiber, 35 percent rubbed; moderate very thin platy structure; slightly sticky; few roots; primarily woody fibers; about 12 percent woody fragments 1 inch in diameter and 1 to 6 inches in length; very strongly acid (pH 4.4 in water); clear wavy boundary.

Oe4—29 to 60 inches; hemic material, very dark brown (10YR 2/2) broken face and rubbed; about 50 percent fiber, 20 percent rubbed; massive; slightly sticky; primarily herbaceous fibers; extremely acid (pH 4.4 in water).

The thickness of the organic material exceeds 51 inches. The subsurface and bottom tiers have hue of 10YR, 7.5YR, or 5YR; value of 2 to 5; and chroma of 2 to 4. Some pedons have 5 to 15 percent, by volume, woody fragments mixed throughout the organic material.

## Guenther Series

The Guenther series consists of deep, moderately well drained soils on uplands. These soils formed in sandy deposits underlain by loamy glacial till or in residuum derived from igneous and metamorphic rock, or in both. Permeability is rapid in the upper part of the subsoil and moderate in the lower part and in the substratum. Slope ranges from 2 to 6 percent.

These soils have a thicker transition layer between the sandy upper deposits and the gravelly loam lower deposits than is defined as the range for the Guenther series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Guenther loamy sand, 2 to 6 percent slopes, 1,250 feet east and 300 feet south of the center of sec. 10, T. 28 N., R. 8 E.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; common fine roots; about 5 percent gravel; very strongly acid; abrupt smooth boundary.

Bs1—9 to 19 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; about 5 percent gravel; strongly acid; gradual wavy boundary.

Bs2—19 to 26 inches; brown (7.5YR 5/4) loamy sand;

weak medium subangular blocky structure; very friable; few fine roots; about 4 percent gravel; strongly acid; clear wavy boundary.

B/E—26 to 31 inches; 80 percent dark yellowish brown (10YR 4/4) loamy sand (Bt); common medium prominent yellowish red (5YR 4/8) mottles in the lower part; moderate coarse subangular blocky structure; friable; few fine roots; few clay bridges between sand grains in the Bt part; tongues of brown (10YR 5/3) loamy sand (E); about 4 percent gravel; strongly acid; clear wavy boundary.

2Bt—31 to 37 inches; dark brown (7.5YR 4/4) fine sandy loam; common coarse prominent yellowish red (5YR 4/8) mottles; moderate medium and coarse subangular blocky structure; friable; few fine roots; common faint discontinuous clay films and uncoated sand grains on vertical faces of peds; about 10 percent gravel and 4 percent cobbles; strongly acid; clear wavy boundary.

2C—37 to 60 inches; dark brown (7.5YR 4/4) and brown (10YR 5/3) gravelly loam; common medium prominent yellowish red (5YR 4/8) mottles in the upper 15 inches; massive; friable; about 15 percent gravel and 10 percent cobbles; medium acid.

The thickness of the solum ranges from 30 to 45 inches. The thickness of the sandy deposits ranges from 20 to 40 inches. The content of gravel ranges from 0 to 5 percent in the upper part of the solum, from 0 to 10 percent in the lower part of the solum, and from 0 to 30 percent in the substratum. The content of cobbles in the loamy lower part of the subsoil and in the substratum ranges from 0 to 10 percent.

The Ap horizon or the A horizon, where it occurs, has value and chroma of 2 or 3. The Bs horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 or 4. It is sand or loamy sand. The 2Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 or 5. This horizon has mottles with chroma of 6 to 8. It is sandy loam, fine sandy loam, or loam. The 2C horizon is sandy loam, gravelly sandy loam, loam, or gravelly loam.

## Hatley Series

The Hatley series consists of deep, somewhat poorly drained soils on terminal, recessional, and ground moraines. These soils formed in silty and loamy deposits and in the underlying loamy or sandy glacial till. Permeability is moderate in the subsoil and moderate or moderately rapid in the substratum. Slope ranges from 1 to 6 percent.

Typical pedon of Hatley cobbly silt loam, 1 to 6 percent slopes, bouldery, 750 feet north and 1,800 feet east of the southwest corner of sec. 25, T. 28 N., R. 10 E.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) cobbly silt loam, light brownish gray (10YR 6/2) dry; common fine prominent yellowish brown (10YR 5/8) mottles in root channels; weak very fine subangular blocky structure; very friable; about 15 percent cobbles and 2 percent gravel; common fine roots; very strongly acid; abrupt wavy boundary.

Bs—5 to 8 inches; dark brown (10YR 4/3) cobbly silt loam; common fine prominent yellowish brown (10YR 5/8) mottles in root channels; weak fine subangular blocky structure; very friable; about 15 percent cobbles and 4 percent gravel; few fine roots; common very dark gray (10YR 3/1) earthworm casts; strongly acid; clear wavy boundary.

E/B—8 to 14 inches; 80 percent brown (10YR 5/3) cobbly silt loam (E), light gray (10YR 7/2) dry; few fine prominent yellowish brown (10YR 5/8) and few fine faint light brownish gray (10YR 6/2) mottles; weak medium platy structure; very friable; remnants of dark brown (7.5YR 4/4) loam (Bt); weak very fine subangular blocky structure; very friable; about 15 percent cobbles and 5 percent gravel; few fine roots; common fine very dark gray (10YR 3/1) earthworm casts; strongly acid; gradual irregular boundary.

B/E—14 to 20 inches; 75 percent dark brown (7.5YR 4/4) loam (Bt); common fine distinct light brownish gray (10YR 6/2) and few fine prominent yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable; tongues of brown (10YR 5/3) silt loam (E), light gray (10YR 7/2) dry; weak thin platy structure; friable; few faint dark brown (7.5YR 3/4) patchy clay films of faces of Bt peds; about 5 percent cobbles and 5 percent gravel; few fine roots; very strongly acid; gradual wavy boundary.

Bt—20 to 32 inches; dark brown (7.5YR 4/4) loam; common medium prominent strong brown (7.5YR 5/8) and common medium distinct pinkish gray (7.5YR 6/2) mottles; moderate very fine subangular blocky structure; friable; common distinct strong brown (7.5YR 4/6) discontinuous clay films on faces of peds; about 5 percent cobbles and 5 percent gravel; few fine roots; very strongly acid; gradual wavy boundary.

BC—32 to 44 inches; dark brown (7.5YR 4/4) sandy loam; common fine prominent strong brown (7.5YR 5/8) and few fine distinct pinkish gray (7.5YR 6/2) mottles; weak very fine subangular

blocky structure; very friable; about 5 percent cobbles and 8 percent gravel; very strongly acid; gradual wavy boundary.
C—44 to 60 inches; brown (7.5YR 5/4) loamy sand; few fine prominent strong brown (7.5YR 5/8) mottles; massive; very friable; about 5 percent cobbles and stones and 8 percent gravel; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The thickness of the silty deposits ranges from 0 to 15 inches. The content of gravel ranges from 0 to 20 percent throughout the solum and from 5 to 25 percent in the substratum. The content of cobbles ranges from 0 to 15 percent throughout the solum and substratum. The content of cobbles, stones, and boulders in the surface horizon of the bouldery phase is 15 to 35 percent.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or cobbly silt loam. The Ap horizon, where it occurs, has value and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 or 5. It is loam, gravelly loam, sandy loam, or gravelly sandy loam. Mottles with chroma of 1 or 2 and 6 to 8 are in this horizon. The C horizon is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand. Small pockets of sand and gravel occur in some pedons.

## Kennan Series

The Kennan series consists of deep, well drained soils on terminal and recessional moraines and drumlins. These soils formed in loamy deposits and in the underlying loamy sand or sandy loam glacial till. Permeability is moderate in the subsoil and moderate or moderately rapid in the substratum. Slope ranges from 2 to 30 percent.

Typical pedon of Kennan sandy loam, 8 to 15 percent slopes, 2,000 feet east and 250 feet north of the southwest corner of sec. 27, T. 28 N., R. 9 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many fine roots; about 5 percent gravel; strongly acid; abrupt smooth boundary.
E/B—8 to 16 inches; 80 percent brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry (E); weak thick platy structure parting to moderate very fine subangular blocky; friable; dark brown (7.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; few faint dark brown (7.5YR 3/4) clay films on faces of peds; common fine roots; about 5 percent gravel; medium acid; gradual wavy boundary.
B/E—16 to 26 inches; 70 percent dark brown (7.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; few faint dark brown (7.5YR 3/4) clay films on faces of peds; tongues of brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; friable; common fine roots; about 10 percent gravel; strongly acid; gradual wavy boundary.
Bt1—26 to 40 inches; dark brown (7.5YR 4/4) sandy loam; moderate fine subangular blocky structure; friable; common faint dark brown (7.5YR 3/4) clay films on faces of peds; brown (10YR 5/3) uncoated silt and very fine sand grains on vertical faces of peds, mainly in the upper 6 inches of the horizon; few fine roots; about 10 percent gravel and 2 percent cobbles; medium acid; gradual wavy boundary.
Bt2—40 to 48 inches; dark brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; friable; common clay coatings on sand grains; few fine roots; about 10 percent gravel and 2 percent cobbles; medium acid; clear wavy boundary.
C—48 to 60 inches; brown (7.5YR 5/4) loamy sand; massive; friable; few fine roots; about 10 percent gravel and 5 percent cobbles; neutral.

The thickness of the solum ranges from 40 to more than 60 inches. The content of gravel ranges from 0 to 15 percent in the upper part of the solum, from 5 to 20 percent in the lower part of the solum, and from 10 to 25 percent in the substratum. The content of boulders, stones, and cobbles in the surface horizon of the bouldery phases is 15 to 35 percent.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bt1 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 or 5. It is loam, fine sandy loam, or sandy loam. The Bt2 horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 4 or 5. It is loam, sandy loam, loamy sand, or the gravelly analogs of these textures. The C horizon is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand. Small pockets or discontinuous lenses of sand and gravel occur in some pedons.

## Loyal Series

The Loyal series consists of very deep, moderately well drained soils on ground moraines. These soils formed in silty deposits and in the underlying loamy glacial till. Permeability is moderate in the silty part and extremely slow to slow in the loamy till. Slope ranges from 1 to 12 percent.

Typical pedon of Loyal silt loam, 1 to 6 percent slopes, 700 feet north and 1,200 feet east of the southwest corner of sec. 25, T. 28 N., R. 2 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

E—9 to 14 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate thick platy structure parting to moderate fine subangular blocky; friable; few fine roots; common medium distinct brownish yellow (10YR 6/6) mottles; neutral; abrupt smooth boundary.

E/B—14 to 20 inches; 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; friable; tongues into and surrounds remnants of brown (7.5YR 5/4) silt loam (Bt); strong coarse prismatic structure parting to strong medium and coarse subangular blocky; firm; few faint dark brown (7.5YR 4/4) clay films on faces of peds; few fine roots; common medium prominent and distinct strong brown (7.5YR 5/6) mottles; strongly acid; clear wavy boundary.

2B/E—20 to 25 inches; 75 percent reddish brown (5YR 5/4) loam (2Bt); strong coarse prismatic structure parting to strong coarse subangular blocky; firm; few faint reddish brown (5YR 4/4) clay films on faces of peds; penetrated by tongues of brown (7.5YR 5/3) silt loam (E), light brown (7.5YR 6/3) dry; moderate coarse subangular blocky structure; friable; common medium prominent strong brown (7.5YR 5/8) mottles; about 4 percent gravel; very strongly acid; clear wavy boundary.

2Bt1—25 to 37 inches; dark reddish brown (5YR 3/4) loam; strong coarse prismatic structure parting to strong coarse subangular blocky; firm; common faint dark reddish brown (5YR 3/3) clay films on faces of peds; common medium prominent strong brown (7.5YR 5/8) mottles; about 8 percent gravel; very strongly acid; gradual smooth boundary.

2Bt2—37 to 49 inches; dark reddish brown (5YR 3/4) loam; moderate coarse subangular blocky structure; firm; few faint dark reddish brown (5YR 3/3) clay films on vertical faces of peds; common medium prominent strong brown (7.5YR 5/8) mottles; about 5 percent gravel; strongly acid; gradual smooth boundary.

2C—49 to 60 inches; reddish brown (5YR 4/4) loam; massive; firm; common medium prominent strong brown (7.5YR 5/8) mottles; about 4 percent gravel; strongly acid.

The thickness of the solum ranges from 24 to 50 inches. The thickness of the silty deposits ranges from 12 to 36 inches. The content of gravel ranges from 0 to 10 percent in the silty deposits and from 3 to 35 percent in the underlying loamy till.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The E horizon and the E part of the E/B or B/E horizon (where it occurs) have value of 4 to 6 and chroma of 2 or 3. Where moist colors are 4/3 or 5/3, dry value is 7 or more. The 2E part of the 2B/E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. Where moist colors are 4/3 or 5/3, dry value is 7 or more. The 2E part of the 2B/E horizon is loam or gravelly loam. The Bt part of the E/B or B/E horizon (where it occurs) has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The 2Bt part of the 2B/E horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is loam, sandy clay loam, clay loam, or the gravelly analogs of these textures. The 2Bt and 2C horizons have hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. They are sandy loam, loam, sandy clay loam, or the gravelly analogs of these textures.

## Magnor Series

The Magnor series consists of deep, somewhat poorly drained soils on ground moraines. These soils formed in silty deposits and in the underlying loamy glacial till. Permeability is moderate in the silty upper part of the profile and extremely slow to slow in the loamy till. Slope ranges from 0 to 4 percent.

Typical pedon of Magnor silt loam, 0 to 4 percent slopes, 2,800 feet north and 1,200 feet east of the southwest corner of sec. 6, T. 30 N., R. 9 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; friable; many fine roots; about 4 percent gravel; medium acid; abrupt smooth boundary.

E/B—10 to 16 inches; 70 percent pale brown (10YR 6/3) silt loam (E), very pale brown (10YR 7/3) dry; common medium prominent strong brown (7.5YR 5/8) and common medium faint light brownish gray (10YR 6/2) mottles; moderate medium platy structure; friable; remnants of strong brown (7.5YR 5/6) silt loam (Bt); moderate very fine subangular blocky structure; friable; few fine roots;

about 4 percent gravel; strongly acid; clear wavy boundary.

2B/E—16 to 24 inches; 75 percent yellowish red (5YR 4/6) sandy loam (Bt); common medium distinct yellowish red (5YR 5/8) and common medium prominent pinkish gray (5YR 6/2) mottles; moderate very fine subangular blocky structure; friable; few prominent weak red (2.5YR 5/2) clay films on faces of peds (Bt); tongues and a few interfingers of pinkish gray (7.5YR 7/2) sandy loam (E); weak medium platy structure; friable; few fine roots; about 9 percent gravel; strongly acid; gradual wavy boundary.

2Bt1—24 to 29 inches; yellowish red (5YR 4/6) sandy loam; common medium distinct yellowish red (5YR 5/8) and common medium distinct pinkish gray (5YR 6/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; common prominent weak red (2.5YR 5/2) clay films on vertical and horizontal faces of peds; a few pinkish gray (7.5YR 7/2) uncoated sand grains on vertical faces of peds; about 8 percent gravel; strongly acid; gradual wavy boundary.

2Bt2—29 to 39 inches; reddish brown (2.5YR 4/4) sandy loam; common medium prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; firm; common faint weak red (2.5YR 5/2) clay films on vertical faces of peds; about 10 percent gravel; medium acid; gradual wavy boundary.

2Bt3—39 to 50 inches; reddish brown (5YR 4/4) sandy loam; few medium distinct yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; firm; few distinct weak red (2.5YR 5/2) clay films on vertical faces of peds; about 14 percent gravel; medium acid; clear wavy boundary.

2Cd—50 to 60 inches; dark reddish brown (2.5YR 3/4) gravelly sandy loam; few medium prominent yellowish red (5YR 5/8) mottles; massive; firm; about 16 percent gravel and 1 percent cobbles; slightly acid.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the silty deposits ranges from 15 to 30 inches. The content of gravel ranges from 0 to 5 percent in the upper part of the solum and from 5 to 20 percent in the lower part and in the substratum. The content of cobbles and stones ranges from 0 to 10 percent in the solum and substratum.

The Ap horizon has chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. Some pedons have a Bt horizon. This horizon is silt loam. The 2Bt horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 4 or 5; and chroma of 3 to 6. It is sandy loam, loam, or the gravelly analogs of these textures. The 2Cd horizon has textures similar to those of the 2Bt horizon.

## Mahtomedi Series

The Mahtomedi series consists of deep, excessively drained and moderately well drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy deposits. Slope ranges from 0 to 45 percent.

Typical pedon of Mahtomedi loamy sand, 0 to 6 percent slopes, 100 feet north and 850 feet east of the southwest corner of sec. 14, T. 28 N., R. 7 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; common fine roots; about 2 percent gravel; strongly acid; abrupt smooth boundary.

Bw1—8 to 18 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; about 1 percent gravel; strongly acid; gradual wavy boundary.

Bw2—18 to 24 inches; dark brown (7.5YR 4/4) gravelly loamy sand; weak coarse subangular blocky structure; very friable; few fine roots; about 23 percent gravel; strongly acid; gradual wavy boundary.

C—24 to 60 inches; light brown (7.5YR 6/4) gravelly coarse sand; single grain; loose; about 23 percent gravel; medium acid.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel ranges from 0 to 15 percent in the upper part of the solum and from 10 to 35 percent in the lower part and in the substratum.

The Ap horizon has hue of 10YR or 7.5YR and value and chroma of 2 or 3. The A horizon, where it occurs, has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The Bw1 horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4. It is loamy sand or sand. The Bw2 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand, loamy coarse sand, sand, coarse sand, or the gravelly analogs of these textures. The C horizon is sand, gravelly sand, coarse sand, or gravelly coarse sand. In some pedons there is stratification of the sand and gravel. Some pedons have mottles with chroma of 6 to 8 at a depth of 30 to 60 inches.

## Marathon Series

The Marathon series consists of deep, well drained soils on uplands. These soils formed in silty deposits and the underlying loamy glacial till and residuum (grus) derived from granite. Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. Slope ranges from 2 to 15 percent.

Typical pedon of Marathon silt loam, 2 to 6 percent slopes, 150 feet west and 2,440 feet north of the southeast corner of sec. 34, T. 28 N., R. 6 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable; many fine fibrous roots; about 2 percent gravel; very strongly acid; abrupt smooth boundary.

E—7 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak thin platy structure; friable; common fine fibrous roots; about 2 percent gravel; very strongly acid; abrupt smooth boundary.

E/B—10 to 18 inches; 80 percent brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry (E); weak thin platy structure; very friable; remnants of brown (7.5YR 5/4) and dark brown (7.5YR 4/4) silt loam (Bt); weak fine subangular blocky structure; friable; common fine fibrous roots; few faint clay films on faces of peds in Bt remnants and in some pores; about 2 percent gravel; very strongly acid; clear wavy boundary.

B/E—18 to 29 inches; 60 percent dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common faint clay films on faces of peds and in tubular pores; tongues of brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry (E); weak thin platy structure; very friable; few fine fibrous roots; about 2 percent gravel; strongly acid; clear wavy boundary.

2Bt1—29 to 38 inches; dark brown (7.5YR 4/4) and brown (7.5YR 5/4) very gravelly coarse sandy loam; weak medium subangular blocky structure; firm; many distinct dark brown (7.5YR 3/2) clay films on surfaces of gravel and coatings on sand grains; about 55 percent angular and subangular gravel; very strongly acid; clear wavy boundary.

2Bt2—38 to 57 inches; mixed dark brown (7.5YR 4/4), strong brown (7.5YR 5/6 and 5/8), and yellowish red (5YR 5/8) extremely gravelly loamy coarse sand; weak coarse subangular blocky structure; friable; common distinct dark brown (7.5YR 3/2) clay films on surfaces of gravel and sand grains and as bridges between sand grains; about 75 percent angular and subangular gravel; strongly acid; gradual wavy boundary.

2C—57 to 60 inches; strong brown (7.5YR 5/6 and 5/8) extremely gravelly loamy coarse sand; single grain; about 90 percent gravel; strongly acid.

The thickness of the solum ranges from 40 to 65 inches. The thickness of the silty deposits ranges from 15 to 35 inches. The content of gravel ranges from 0 to 15 percent in the silty upper part of the solum, from 30 to 75 percent in the lower part of the solum, and from 15 to 90 percent in the substratum. The content of cobbles or stones ranges from 0 to 2 percent in the silty deposits and from 0 to 8 percent in the till and residuum. The content of cobbles and stones in the surface horizon of the stony phase is 15 to 35 percent.

The Ap horizon has value of 2 to 4 and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The 2Bt1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is gravelly or very gravelly sandy loam, gravelly or very gravelly coarse sandy loam, or gravelly or very gravelly loam. The 2Bt2 horizon has colors similar to those of the 2Bt1 horizon. It is gravelly, very gravelly or extremely gravelly loamy coarse sand or gravelly, very gravelly, or extremely coarse sandy loam. The 2C horizon is extremely gravelly or very gravelly loamy coarse sand.

## Marshfield Series

The Marshfield series consists of deep, poorly drained soils in depressions and drainageways on ground moraines. These soils formed in silty deposits and in the underlying loamy glacial till. Permeability is moderate or moderately slow. Slope ranges from 0 to 3 percent.

Typical pedon of Marshfield silt loam, 0 to 3 percent slopes, 2,600 feet south and 50 feet east of the northwest corner of sec. 1, T. 26 N., R. 3 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, light brownish gray (10YR 6/2) dry; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium granular structure; friable; common fine roots; about 3 percent gravel; very strongly acid; abrupt smooth boundary.

Eg—8 to 16 inches; grayish brown (2.5Y 5/2) silt loam; common fine prominent strong brown (7.5YR 5/8) mottles; moderate thin platy structure; friable; few fine roots; about 3 percent gravel; strongly acid; clear wavy boundary.

Btg1—16 to 23 inches; light brownish gray (2.5Y 6/2) silt loam; common fine prominent yellowish brown

(10YR 5/8) and common medium prominent strong brown (7.5YR 5/8) mottles; strong medium subangular blocky structure; firm; common faint dark grayish brown (10YR 4/2) discontinuous clay films on faces of all peds; few fine roots; about 7 percent gravel; slightly acid; clear wavy boundary.

2Btg2—23 to 34 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/8) and common medium prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; firm; few faint dark grayish brown (10YR 4/2) discontinuous clay films on vertical faces of peds; about 8 percent gravel; neutral; clear wavy boundary.

2C—34 to 60 inches; dark yellowish brown (10YR 4/4) sandy loam; common medium prominent strong brown (7.5YR 5/8) and common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; about 12 percent gravel; neutral.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the silty deposits ranges from 15 to 36 inches. The content of gravel ranges from 0 to 15 percent in the solum and substratum. The content of cobbles ranges from 0 to 15 percent in the lower part of the solum and in the substratum.

The Ap horizon or the A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Eg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The Btg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. The 2Btg horizon has the same colors as those of the Btg horizon. It is loam, sandy clay loam, or clay loam. The 2C horizon is sandy loam, clay loam, sandy clay loam, or loam.

## Meadland Series

The Meadland series consists of deep, somewhat poorly drained, moderately permeable or moderately slowly permeable soils on ground moraines. These soils formed in loamy deposits and in the underlying loamy glacial till, in loamy residuum derived from igneous and metamorphic rock, or in both. Slope ranges from 0 to 3 percent.

Typical pedon of Meadland loam, 0 to 3 percent slopes, 1,000 feet east and 1,000 feet north of the center of sec. 20, T. 27 N., R. 8 E.

Oe—2 inches to 0; black (10YR 2/1) layer of partially decomposed leaves, twigs, and roots.

A—0 to 2 inches; very dark brown (10YR 2/2) loam; weak very fine granular structure; friable; many fine roots; about 3 percent gravel; medium acid; clear wavy boundary.

Bs—2 to 7 inches; dark brown (10YR 4/3) loam; moderate fine subangular blocky structure; very friable; common fine roots; about 3 percent gravel; medium acid; clear wavy boundary.

E/B—7 to 16 inches; 70 percent brown (10YR 5/3) loam (E), very pale brown (10YR 7/3) dry; few fine faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to moderate very fine subangular blocky; friable; remnants of dark yellowish brown (10YR 4/4) loam (Bt); weak fine subangular blocky structure; friable; common fine roots; about 3 percent gravel; medium acid; gradual wavy boundary.

B/E—16 to 25 inches; 70 percent dark yellowish brown (10YR 4/4) loam (Bt); common medium distinct grayish brown (10YR 5/2) and common medium prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; few faint dark brown (7.5YR 4/4) clay films on horizontal faces of peds (Bt); common fine roots; tongues of brown (10YR 5/3) loam (E); about 3 percent gravel; strongly acid; clear wavy boundary.

Bt1—25 to 36 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct grayish brown (10YR 5/2) and many medium prominent strong brown (7.5YR 5/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; friable; few fine roots; brown (10YR 5/3) sandy loam coatings on vertical faces of some peds; few faint dark brown (7.5YR 4/4) clay films on horizontal faces of peds; about 12 percent gravel; strongly acid; clear wavy boundary.

Bt2—36 to 41 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct grayish brown (10YR 5/2) and common medium prominent strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on vertical faces of peds; about 4 percent gravel; strongly acid; clear wavy boundary.

C—41 to 60 inches; dark yellowish brown (10YR 4/4), grayish brown (10YR 5/2), strong brown (7.5YR 5/6), and olive brown (2.5Y 4/4) gravelly loam; massive; friable; about 16 percent gravel; strongly acid.

The thickness of the solum ranges from 24 to 48 inches. The content of gravel ranges from 0 to 15 percent in the solum and from 0 to 30 percent in the substratum. The content of cobbles and stones in the surface horizon of the stony phase is 15 to 35 percent.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Ap horizon, where it occurs, has value and

chroma of 2 or 3. The Bt horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 4 to 8. This horizon has mottles with chroma of 2 to 8. It is sandy loam, loam, sandy clay loam, or clay loam. The C horizon is sandy loam, loam, sandy clay loam, clay loam, or the gravelly analogs of these textures.

## Meehan Series

The Meehan series consists of deep, somewhat poorly drained, rapidly permeable soils on outwash plains, stream terraces, and glacial lake plains. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Meehan loamy sand, 0 to 2 percent slopes, 1,700 feet north and 1,500 feet west of the southeast corner of sec. 34, T. 26 N., R. 6 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy sand, brown (10YR 5/3) dry; moderate fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

Bw1—10 to 13 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; few fine roots; slightly acid; clear wavy boundary.

Bw2—13 to 22 inches; strong brown (7.5YR 4/6) loamy sand; common medium distinct yellowish red (5YR 5/6) and few fine distinct brown (7.5YR 5/2) mottles; weak fine subangular blocky structure; very friable; few fine roots; slightly acid; clear wavy boundary.

BC—22 to 30 inches; strong brown (7.5YR 5/6) sand; common medium distinct brown (7.5YR 5/2) and many medium prominent reddish brown (5YR 4/4) mottles; single grain; loose; slightly acid; clear wavy boundary.

C—30 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 24 to 36 inches. The content of gravel in the solum and substratum ranges from 0 to 15 percent.

The Ap horizon or the A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 2 to 6. It is sand or loamy sand.

## Minocqua Series

The Minocqua series consists of deep, poorly drained and very poorly drained soils in drainageways and depressions on outwash plains. These soils formed in loamy deposits and in the underlying sand and gravel. Permeability is moderate in the upper part of the soils and rapid in the substratum. Slope ranges from 0 to 2 percent.

These soils have more sand in the upper part of the control section than is defined as the range for the Minocqua series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Minocqua sandy loam, 0 to 2 percent slopes 1,420 feet south and 2,550 feet east of the northwest corner of sec. 26, T. 28 N., R. 8 E.

A—0 to 5 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many fine roots; about 10 percent gravel; strongly acid; abrupt wavy boundary.

Bg1—5 to 13 inches; gray (10YR 5/1) sandy loam; few fine prominent yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable; few fine roots; about 5 percent gravel; strongly acid; clear wavy boundary.

Bg2—13 to 19 inches; grayish brown (10YR 5/2) sandy loam; common fine prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 10 percent gravel; medium acid; clear wavy boundary.

2BCg—19 to 23 inches; dark grayish brown (10YR 4/2) gravelly loamy sand; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; few fine roots; about 25 percent gravel; medium acid; clear wavy boundary.

2Cg—23 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grain; loose; about 30 percent gravel; slightly acid.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel ranges from 0 to 15 percent in the upper part of the solum, from 0 to 35 percent in the lower part of the solum, and from 0 to 60 percent in the substratum.

Some pedons have an Oa horizon. This horizon ranges from 0 to 8 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 10YR or 2.5Y and value of 4 to 6. It is silt loam, loam, sandy loam, or fine sandy loam. The 2BCg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is loamy coarse sand, gravelly loamy coarse sand, loamy sand, gravelly loamy sand, or gravelly sandy loam. The 2Cg horizon is sand, coarse sand, loamy sand, or the gravelly or very gravelly analogs of these textures.

## Moberg Series

The Moberg series consists of deep, somewhat excessively drained, rapidly permeable soils on uplands. These soils formed in thin deposits of silty material and in the underlying residuum (grus) derived from granite. Slope ranges from 2 to 15 percent.

Typical pedon of Moberg gravelly silt loam, 6 to 15 percent slopes, 1,500 feet east and 50 feet north of the southwest corner of sec. 32, T. 28 N., R. 6 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; many fine roots; about 15 percent angular granitic gravel; very strongly acid; abrupt wavy boundary.

Bw—4 to 12 inches; dark brown (7.5YR 4/4) gravelly silt loam; moderate very fine subangular blocky structure; friable; common fine roots; about 30 percent angular granitic gravel; very strongly acid; clear wavy boundary.

2BC—12 to 20 inches; strong brown (7.5YR 4/6) very gravelly coarse sandy loam; weak very fine subangular blocky structure; very friable; few fine roots; about 60 percent angular granitic gravel; very strongly acid; clear wavy boundary.

2C—20 to 60 inches; strong brown (7.5YR 5/6) extremely gravelly loamy coarse sand; single grain; loose; about 80 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 15 to 30 inches. The thickness of the silty deposits ranges from 0 to 15 inches. The content of gravel ranges from 10 to 35 percent in the A and Bw horizons and from 35 to 90 percent in the 2BC and 2C horizons. The content of cobbles is 0 to 2 percent in the A and Bw horizons and 0 to 8 percent in the 2BC and 2C horizons.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Ap horizon, where it occurs, has value of 3 or 4 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 4 or 5. It is silt loam, loam, or the gravelly analogs of these textures. The 2BC horizon has hue of 7.5YR or 5YR and value and chroma of 4 to 6. It is very gravelly or extremely gravelly loamy sand, very gravelly or extremely gravelly loamy coarse sand, very gravelly or extremely gravelly coarse sandy loam, or very gravelly or extremely gravelly sandy loam. The 2C horizon is extremely gravelly loamy coarse sand or very gravelly loamy coarse sand.

## Mosinee Series

The Mosinee series consists of deep, well drained, moderately permeable or moderately rapidly permeable soils on uplands underlain by bedrock. These soils formed in loamy deposits and the underlying shattered igneous and metamorphic bedrock. Slope ranges from 2 to 20 percent.

Typical pedon of Mosinee sandy loam, 2 to 6 percent slopes, 2,500 feet south and 1,000 feet east of the northwest corner of sec. 3, T. 26 N., R. 7 E.

Ap—0 to 7 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; moderate very fine subangular blocky structure; friable; some dark yellowish brown (10YR 4/4) soil mixed in by plowing; few fine roots; about 12 percent angular gravel and 1 percent angular cobbles; very strongly acid; abrupt smooth boundary.

Bw1—7 to 14 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; moderate fine subangular blocky structure; friable; few fine roots; about 25 percent angular gravel and 1 percent angular cobbles; very strongly acid; clear wavy boundary.

Bw2—14 to 19 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; moderate fine subangular blocky structure; friable; few fine roots; about 33 percent angular gravel and 2 percent angular cobbles; strongly acid; clear wavy boundary.

Bw3—19 to 30 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; moderate fine and very fine subangular blocky structure; friable; few dark brown (7.5YR 4/4) clay films on pebbles and cobbles; few fine roots; about 50 percent angular gravel and 5 percent angular cobbles; strongly acid; gradual wavy boundary.

Bw4—30 to 42 inches; yellowish brown (10YR 5/4) extremely gravelly sandy loam; weak very fine subangular blocky structure; few dark brown (7.5YR 4/4) clay films on pebbles and cobbles; about 75 percent angular gravel and 10 percent angular cobbles; medium acid; abrupt irregular boundary.

R—42 inches; fine grained igneous and metamorphic rock, fractured in place.

The thickness of the solum ranges from 25 to 45 inches. Some pedons have a substratum. The depth to fractured igneous and metamorphic rock ranges from 40 to 60 inches. The content of gravel ranges from 0 to 15 percent in the surface horizon, from 5 to 35 percent in the upper part of the subsoil, and from 20 to 75

percent in the lower part and in the substratum. The content of cobbles ranges from 0 to 10 percent in the surface horizon, from 2 to 15 percent in the upper part of the subsoil, and from 5 to 50 percent in the lower part of the subsoil. It is 40 to 60 percent in the substratum. The content of cobbles and stones in the surface horizon of the stony phase is 15 to 35 percent.

The Ap horizon has chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bw1 and Bw2 horizons have hue of 10YR or 7.5YR and value and chroma of 4 or 5. They are loam, fine sandy loam, sandy loam, or the gravelly analogs of these textures. The Bw3 and Bw4 horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are gravelly or cobbly sandy loam, gravelly or cobbly loam, very gravelly or very cobbly sandy loam, very gravelly or very cobbly loam, or extremely gravelly sandy loam.

## Mylrea Series

The Mylrea series consists of deep, somewhat poorly drained soils on ground moraines. These soils formed in silty deposits and in the underlying loamy glacial till and residuum (grus) derived from granite. Permeability is moderate in the subsoil and rapid in the substratum. Slope ranges from 1 to 6 percent.

Typical pedon of Mylrea silt loam, 1 to 6 percent slopes, 750 feet east and 100 feet south of the northwest corner of sec. 3, T. 27 N., R. 6 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; friable; many fine roots; about 3 percent gravel; very strongly acid; clear wavy boundary.

Bs—3 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium and coarse subangular blocky structure; friable; common fine roots; about 3 percent gravel; very strongly acid; clear wavy boundary.

E—9 to 12 inches; light brownish gray (10YR 6/2) silt loam; few fine prominent strong brown (7.5YR 5/6) mottles; moderate medium platy structure parting to moderate very fine subangular blocky; friable; common fine roots; about 4 percent gravel; very strongly acid; clear wavy boundary.

B/E—12 to 19 inches; 80 percent dark yellowish brown (10YR 4/4) silt loam (Bt); few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; friable; tongues of pale brown (10YR 6/3) silt loam (E); weak thin platy structure; very friable; few fine roots; about 4 percent gravel; very strongly acid; gradual wavy boundary.

Bt1—19 to 28 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; friable; few fine roots; few faint dark brown (7.5YR 4/4) clay films on horizontal faces of peds; pale brown (10YR 6/3) tongues in the upper part of this horizon; about 8 percent gravel; very strongly acid; clear wavy boundary.

2Bt2—28 to 33 inches; dark brown (7.5YR 4/4) fine sandy loam; common medium distinct strong brown (7.5YR 5/6) and pinkish gray (7.5YR 6/2) mottles; moderate coarse subangular blocky structure; friable; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; about 5 percent gravel; very strongly acid; gradual wavy boundary.

2BC—33 to 38 inches; dark brown (7.5YR 4/4) gravelly fine sandy loam; common medium distinct strong brown (7.5YR 5/6) and pinkish gray (7.5YR 6/2) mottles; moderate coarse subangular blocky structure; friable; about 15 percent gravel; strongly acid; clear wavy boundary.

3C—38 to 60 inches; brown (10YR 5/3) extremely gravelly loamy coarse sand; few fine prominent strong brown (7.5YR 5/6) mottles; single grain; loose; about 60 percent angular gravel; strongly acid.

The thickness of the solum ranges from 24 to 60 inches. The thickness of the silty deposits ranges from 15 to 36 inches. The content of gravel ranges from 0 to 10 percent in the silty upper part of the solum; from 2 to 20 percent in the lower part of the solum, which formed in till; and from 15 to 90 percent in the substratum. The content of cobbles is 0 to 2 percent in the silty upper part of the solum and 0 to 8 percent in the lower part and in the substratum. The content of cobbles and stones in the surface horizon of the stony phase is 15 to 35 percent.

The A horizon has value of 2 or 3 and chroma of 0 to 2. The Ap horizon, where it occurs, has value of 2 to 4 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It has mottles with chroma of 2 to 8. The 2Bt horizon has hue of 2.5Y, 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 to 6. It has mottles with chroma of 2 to 8. This horizon is sandy loam, fine sandy loam, loam, or the gravelly analogs of these textures. The 3C horizon is extremely gravelly loamy coarse sand or very gravelly coarse sandy loam.

## Newson Series

The Newson series consists of deep, poorly drained and very poorly drained, rapidly permeable soils in drainageways and depressions on stream terraces, on outwash plains, and in glacial lake basins. These soils formed in a layer of organic material less than 16 inches thick and in the underlying sandy deposits. Slope is 0 to 1 percent.

These soils have a thinner surface layer than is defined as the range for the Newson series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Newson mucky loamy sand, 0 to 1 percent slopes, 2,500 feet west and 700 feet north of the southeast corner of sec. 26, T. 28 N., R. 8 E.

Oi—3 inches to 0; litter layer of dead leaves, twigs, and grass.

A—0 to 3 inches; black (10YR 2/1) mucky loamy sand; moderate fine subangular blocky structure; friable; common medium roots; about 40 percent sapric material; strongly acid; abrupt wavy boundary.

Bg—3 to 12 inches; grayish brown (2.5Y 5/2) loamy sand; few fine prominent brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; very friable; few fine roots; strongly acid; gradual wavy boundary.

BCg—12 to 23 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; very strongly acid; gradual wavy boundary.

Cg—23 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; strongly acid.

The thickness of the solum ranges from 23 to 50 inches. The thickness of the organic material ranges from 0 to 16 inches. It is typically less than 8 inches. The content of gravel ranges from 0 to 15 percent in the solum and substratum.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. The Bg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 1 or 2. It is sand or loamy sand.

## Oesterle Series

The Oesterle series consists of deep, somewhat poorly drained soils on outwash plains and stream terraces. These soils formed in loamy deposits and in the underlying sand or very gravelly sand. Permeability is moderate in the upper part of the subsoil and rapid in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Oesterle loam, 0 to 2 percent slopes, 300 feet north and 1,100 feet west of the southeast corner of sec. 26, T. 28 N., R. 9 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; very friable; common fine roots; about 5 percent gravel; slightly acid; abrupt smooth boundary.

E/B—7 to 10 inches; 60 percent brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; common fine prominent strong brown (7.5YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; very friable; few fine roots; remnants of dark yellowish brown (10YR 4/4) sandy loam (Bt); about 5 percent gravel; slightly acid; clear wavy boundary.

B/E—10 to 14 inches; 70 percent dark brown (7.5YR 4/4) sandy loam (Bt); common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; few fine roots; few clay coatings on sand grains; tongues of pale brown (10YR 6/3) sandy loam (E); about 5 percent gravel; slightly acid; clear wavy boundary.

Bt1—14 to 27 inches; dark brown (7.5YR 4/4) sandy loam; common medium distinct strong brown (7.5YR 5/6) and brown (7.5YR 5/2) mottles; moderate fine subangular blocky structure; friable; few fine roots; common clay coatings on sand grains; about 5 percent gravel; medium acid; clear wavy boundary.

2Bt2—27 to 30 inches; light yellowish brown (10YR 6/4) loamy sand; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; very friable; few clay bridges between sand grains; about 7 percent gravel; medium acid; clear wavy boundary.

2C—30 to 60 inches; light yellowish brown (10YR 6/4) sand; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; single grain; loose; about 10 percent gravel; medium acid.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel ranges from 0 to 20 percent in the the solum and from 5 to 60 percent in the substratum.

The Ap horizon has value and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sandy

loam or loam. The mottles in this horizon have chroma of 1 or 2 or 6 to 8. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 4 to 6. It is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam. The 2C horizon is sand, gravelly sand, very gravelly sand, or gravelly or very gravelly loamy sand.

## Plover Series

The Plover series consists of deep, somewhat poorly drained, moderately permeable soils in glacial lake basins, on delta kames, and on stream terraces. These soils formed in loamy lacustrine deposits underlain by stratified sandy and loamy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Plover sandy loam, 0 to 2 percent slopes, 1,520 feet west and 1,200 feet north of the southeast corner of sec. 7, T. 27 N., R. 10 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.

E—7 to 14 inches; brown (10YR 4/3) sandy loam, very pale brown (10YR 7/3) dry; few fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; very friable; few fine roots; strongly acid; clear wavy boundary.

B/E—14 to 28 inches; 60 percent dark brown (7.5YR 4/4) sandy loam (Bt); common fine distinct light brownish gray (10YR 6/2) and common fine prominent strong brown (7.5YR 5/8) mottles; moderate fine subangular blocky structure; friable; few fine roots; tongues of brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; medium acid; clear wavy boundary.

Bt1—28 to 35 inches; dark brown (7.5YR 4/4) sandy loam; common fine prominent strong brown (7.5YR 5/8) and common medium distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; few faint patchy dark brown (7.5YR 3/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—35 to 42 inches; dark brown (7.5YR 4/4) loam; many medium prominent strong brown (7.5YR 5/8) and many medium distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; few faint patchy dark brown (7.5YR 3/4) clay films on faces of peds; medium acid; clear wavy boundary.

C1—42 to 48 inches; dark brown (7.5YR 4/4), stratified sandy loam and loamy fine sand; common fine prominent strong brown (7.5YR 5/8) and many fine distinct light brownish gray (10YR 6/2) mottles; weak medium platy structure; very friable; medium acid; clear wavy boundary.

C2—48 to 60 inches; yellowish brown (10YR 5/4), stratified sand and sandy loam; common medium prominent strong brown (7.5YR 5/8) mottles; single grain in sand strata; massive in sandy loam strata; very friable; medium acid.

The thickness of the solum ranges from 36 to 48 inches. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 or 5. It is typically loam, sandy loam, or fine sandy loam, but in some pedons it has thin subhorizons of silt loam, very fine sandy loam, loamy fine sand, or loamy sand. The C horizon is stratified with silt loam, sandy loam, loamy fine sand, fine sand, loamy sand, or sand.

## Ribhill Series

The Ribhill series consists of moderately deep, well drained, moderately permeable soils on quartzite monadnocks. These soils formed in silty deposits over quartzite bedrock. Slope ranges from 6 to 30 percent.

Typical pedon of Ribhill cobbly silt loam, 6 to 15 percent slopes, stony, 350 feet north and 600 feet west of the center of sec. 15, T. 28 N., R. 7 E.

Oe—4 inches to 0; litter layer of leaves, twigs, and branches.

A—0 to 4 inches; very dark brown (10YR 2/2) cobbly silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common fine roots; about 15 percent angular gravel and 20 percent angular cobbles; very strongly acid; abrupt wavy boundary.

Bs—4 to 10 inches; dark brown (10YR 4/3) cobbly silt loam; moderate fine subangular blocky structure; friable; common fine roots; about 5 percent angular gravel and 20 percent angular cobbles; very strongly acid; clear wavy boundary.

E/B—10 to 17 inches; 60 percent brown (10YR 5/3) cobbly silt loam (E), very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; friable; remnants of dark yellowish brown (10YR 4/4) cobbly silt loam (Bt); moderate medium subangular blocky structure; friable; few fine roots; about 5 percent angular gravel and 20 percent angular cobbles; strongly acid; gradual wavy boundary.

B/E—17 to 23 inches; 70 percent dark yellowish brown (10YR 4/4) cobbly silt loam (Bt); moderate medium

subangular blocky structure; friable; few faint patchy dark brown (7.5YR 4/4) clay films on horizontal faces of peds; tongues of brown (10YR 5/3) cobbly silt loam (E), very pale brown (10YR 7/3) dry; few fine roots; about 15 percent angular gravel and 25 percent angular cobbles; very strongly acid; gradual wavy boundary.

Bt—23 to 35 inches; dark yellowish brown (10YR 4/4) very cobbly silt loam; moderate fine and medium subangular blocky structure; friable; few fine roots; common faint dark brown (7.5YR 4/4) clay films on faces of peds; about 20 percent angular gravel and 35 percent angular cobbles; very strongly acid; abrupt wavy boundary.

R—35 inches; fractured quartzite with dark yellowish brown (10YR 4/4) silt loam in joints.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of gravel ranges from 2 to 15 percent in the upper part of the solum and from 15 to 25 percent in the lower part. The content of cobbles ranges from 5 to 25 percent in the upper part of the solum and from 20 to 45 percent in the lower part. The content of stones ranges from 15 to 35 percent in the surface horizon and is as much as 25 percent in the lower horizons.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 or 5. It is gravelly, cobbly, or very cobbly silt loam.

## Rietbrock Series

The Rietbrock series consists of deep, somewhat poorly drained, moderately permeable or moderately slowly permeable soils on ground moraines and uplands that are underlain by bedrock. These soils formed in silty deposits underlain by gravelly and cobbly, loamy glacial till or in residuum derived from igneous and metamorphic rock, or in both. They are underlain by igneous and metamorphic bedrock. Slope ranges from 1 to 8 percent.

Typical pedon of Rietbrock silt loam, 1 to 8 percent slopes, 1,200 feet north and 1,200 feet east of the center of sec. 27, T. 29 N., R. 6 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; friable; common fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.

E—8 to 11 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium platy structure parting to moderate very fine subangular blocky; friable; few fine roots; about 3 percent gravel; neutral; clear wavy boundary.

E/B—11 to 15 inches; 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; common fine prominent strong brown (7.5YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; weak medium platy structure; friable; few fine roots; remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine and medium subangular blocky structure; friable; few faint patchy clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

B/E—15 to 22 inches; 60 percent dark brown (7.5YR 4/4) loam (Bt); common fine distinct strong brown (7.5YR 5/6) and few medium distinct brown (7.5YR 5/2) mottles; moderate fine subangular blocky structure; friable; few faint patchy strong brown (7.5YR 4/6) clay films on faces of Bt peds; tongues of brown (10YR 5/3) loam (E), very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; friable; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt1—22 to 29 inches; dark brown (7.5YR 4/4) gravelly loam; common fine distinct strong brown (7.5YR 5/6) and common medium distinct brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; friable; common distinct discontinuous dark brown (7.4YR 4/2) clay films on all faces of peds; few fine roots; about 16 percent gravel and 3 percent cobbles; medium acid; clear wavy boundary.

Bt2—29 to 38 inches; dark brown (7.5YR 4/4) gravelly clay loam; common medium distinct strong brown (7.5YR 5/6) and brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; firm; common distinct discontinuous dark brown (7.5YR 4/2) clay films on vertical faces of peds; few fine roots; about 20 percent gravel and 10 percent angular cobbles; medium acid; clear wavy boundary.

Bt3—38 to 45 inches; dark brown (7.5YR 4/4) very cobbly loam; few fine distinct strong brown (7.5YR 5/6) and brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; friable; few distinct discontinuous dark brown (7.5YR 4/2) clay films on vertical faces of peds; about 20 percent gravel and 20 percent angular cobbles; medium acid; clear wavy boundary.

R—45 inches; shattered igneous and metamorphic rock with dark brown (7.5YR 4/4) loam in joints that diminish with depth.

The thickness of the solum ranges from 36 to 55 inches. The thickness of the silty deposits ranges from 7 to 15 inches. The depth to bedrock ranges from 40

to 60 inches. The content of angular gravel ranges from 0 to 10 percent in the surface and subsurface horizons, from 15 to 35 percent in the upper part of the subsoil, and from 15 to 60 percent in the lower part of the subsoil. The content of angular cobbles ranges from 0 to 5 percent in the surface horizon, from 5 to 15 percent in the upper part of the subsoil, and from 5 to 40 percent in the lower part of the subsoil. The content of stones and cobbles in the surface horizon of the stony phase is 15 to 35 percent.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 7.5YR or 5YR and value and chroma of 4 or 5. The Bt1 and Bt2 horizons are gravelly or cobbly loam, gravelly or cobbly sandy clay loam, or gravelly or cobbly clay loam. The Bt3 horizon is gravelly, very gravelly, cobbly, or very cobbly sandy loam; gravelly, very gravelly, cobbly, or very cobbly loam; or gravelly, very gravelly, cobbly, or very cobbly sandy clay loam.

## Rockers Series

The Rockers series consists of deep, somewhat poorly drained soils on ground moraines. These soils formed in sandy deposits underlain by loamy glacial till or in loamy residuum derived from igneous and metamorphic rock, or in both. Permeability is moderate or moderately rapid in the upper part of the subsoil and moderately slow in the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Rockers loamy sand, 0 to 3 percent slopes, 1,800 feet east and 25 feet south of the northwest corner of sec. 13, T. 26 N., R. 7 E.

A—0 to 3 inches; black (10YR 2/1) loamy sand, gray (10YR 5/1) dry; weak very fine granular structure; very friable; many fine roots; very strongly acid; abrupt wavy boundary.

E—3 to 6 inches; grayish brown (10YR 5/2) loamy sand; weak medium platy structure parting to weak very fine subangular blocky; very friable; common fine roots; very strongly acid; abrupt wavy boundary.

Bhs—6 to 9 inches; dark reddish brown (5YR 3/3) loamy sand; weak fine subangular blocky structure; very friable; common fine roots; very strongly acid; clear wavy boundary.

Bs—9 to 18 inches; dark brown (7.5YR 4/4) loamy sand; few medium distinct yellowish red (5YR 4/6) and few fine distinct brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; very friable; common fine roots; strongly acid; clear wavy boundary.

E/B—18 to 27 inches; 70 percent brown (10YR 5/3) loamy sand (E); common medium prominent yellowish red (5YR 4/6) and common fine faint brown (7.5YR 5/2) mottles; weak thick platy structure parting to weak coarse subangular blocky; very friable; few fine roots; remnants of dark yellowish brown (10YR 4/4) loamy sand (B); a few iron-cemented peds; strongly acid; clear wavy boundary.

2Btg—27 to 38 inches; grayish brown (10YR 5/2) gravelly loam; many medium prominent yellowish red (5YR 4/6) and common medium faint gray (10YR 6/1) mottles; moderate coarse subangular blocky structure; friable; few faint patchy dark brown (7.5YR 4/2) clay films on faces of peds; about 20 percent gravel; very strongly acid; clear wavy boundary.

2C—38 to 60 inches; dark brown (7.5YR 4/4) gravelly sandy loam; common medium prominent yellowish red (5YR 5/8) and common medium distinct grayish brown (2.5Y 5/2) mottles; massive; friable; about 30 percent gravel; very strongly acid.

The thickness of the solum ranges from 36 to 42 inches. The thickness of the sandy deposits ranges from 15 to 30 inches. The content of gravel ranges from 0 to 15 percent in the sandy upper part of the solum and from 5 to 30 percent in the loamy lower part and in the substratum.

The A horizon or Ap horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Bhs horizon has hue of 5YR or 7.5YR and chroma of 2 or 3. It is loamy sand or sandy loam. The Bs horizon has hue of 5YR or 7.5YR and chroma of 3 or 4. This horizon has mottles with chroma of 2 to 8. It is loamy sand or sandy loam. The 2Btg horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. It has mottles with chroma of 2 to 8. It is sandy loam, gravelly sandy loam, loam, or gravelly loam. The 2C horizon has textures similar to those of the 2Btg horizon.

## Rosholt Series

The Rosholt series consists of deep, well drained soils on outwash plains and stream terraces. These soils formed in loamy deposits or in silty and loamy deposits and in the underlying very gravelly sand. Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. Slope ranges from 0 to 6 percent.

Typical pedon of Rosholt sandy loam, 2 to 6 percent slopes, 1,700 feet north and 2,100 feet east of the southwest corner of sec. 3, T. 26 N., R. 9 E.

Ap—0 to 10 inches; very dark grayish brown (10YR

3/2) sandy loam, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; friable; common fine roots; about 10 percent gravel; strongly acid; abrupt smooth boundary.

E/B—10 to 13 inches; 75 percent brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; moderate very fine and fine subangular blocky structure; friable; few fine roots; about 14 percent gravel; dark brown (7.5YR 4/4) sandy loam (Bt); moderate very fine and fine subangular blocky structure; friable; mixed with some Ap horizon material by earthworms; strongly acid; clear wavy boundary.

B/E—13 to 17 inches; 60 percent dark brown (7.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; few distinct patchy strong brown (7.5YR 4/6) clay films on faces of peds; clay coatings on sand grains; few fine roots; about 14 percent gravel; tongues of brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; friable; strongly acid; clear wavy boundary.

2Bt1—17 to 27 inches; dark brown (7.5YR 4/4) gravelly sandy loam; moderate fine and medium subangular blocky structure; friable; few fine roots; about 30 percent gravel; common distinct discontinuous strong brown (7.5YR 4/6) clay films on faces of peds; clay coatings on sand grains; strongly acid; clear wavy boundary.

2Bt2—27 to 30 inches; dark brown (7.5YR 4/4) gravelly loamy coarse sand; moderate medium subangular blocky structure; very friable; very few fine roots; about 30 percent gravel; a few clay bridges between sand grains; medium acid; clear wavy boundary.

2C—30 to 60 inches; brown (7.5YR 5/4) and reddish yellow (7.5YR 6/6) very gravelly sand; single grain; loose; very few fine roots; about 40 percent gravel; stratified sand and gravel; slightly acid.

The thickness of the solum ranges from 24 to 40 inches. The content of gravel ranges from 0 to 15 percent in the loamy upper part of the solum, from 0 to 35 percent in the lower part of the solum, and from 0 to 65 percent in the substratum. The content of cobbles ranges from 0 to 5 percent in the solum and from 0 to 15 percent in the substratum.

The Ap horizon has chroma of 2 or 3. It is silt loam or sandy loam. The A horizon, where it occurs, has textures similar to those of the Ap horizon. It has value of 2 or 3 and chroma of 1 or 2. Some pedons have a Bt horizon. This horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam, loam, or fine sandy loam. The 2Bt horizon has hue of 7.5YR or 5YR and value and chroma of 4 to 6. It is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy coarse sand. The 2C horizon is sand, gravelly sand, or very gravelly sand. Stratification is common.

## Rozellville Series

The Rozellville series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in silty deposits underlain by loamy glacial till or in loamy residuum derived from igneous and metamorphic bedrock, or in both. Slope ranges from 2 to 6 percent.

Typical pedon of Rozellville silt loam, in an area of Fenwood-Rozellville silt loams, 2 to 6 percent slopes, 2,200 feet west and 1,100 feet north of the southeast corner of sec. 36, T. 30 N., R. 7 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; friable; common fine roots; about 3 percent gravel; strongly acid; abrupt smooth boundary.

E—7 to 9 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; weak medium platy structure parting to moderate very fine subangular blocky; friable; few fine roots; about 3 percent gravel; strongly acid; clear wavy boundary.

B/E—9 to 14 inches; 65 percent dark brown (7.5YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; few fine roots; very few faint patchy clay films on horizontal faces of peds; tongues of brown (10YR 5/3) silt loam (E), light gray (10YR 7/2) dry; about 3 percent gravel; strongly acid; gradual wavy boundary.

2Bt1—14 to 26 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; friable; few fine roots; fingers of brown (10YR 5/3) E horizon material through the upper part of the horizon; common distinct discontinuous strong brown (7.5YR 4/6) clay films on faces of peds; about 10 percent gravel and 3 percent cobbles; strongly acid; gradual wavy boundary.

2Bt2—26 to 35 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; few faint patchy dark brown (7.5YR 4/4) clay films on vertical faces of peds; about 12 percent gravel and 3 percent cobbles; strongly acid; clear wavy boundary.

2C—35 to 60 inches; olive brown (2.5Y 4/4) gravelly loam; massive; friable; about 20 percent gravel and 10 percent cobbles; medium acid.

The thickness of the solum ranges from 30 to 40 inches. The content of gravel ranges from 0 to 15

percent in the solum and from 0 to 35 percent in the substratum. The content of cobbles ranges from 0 to 5 percent in the solum and from 10 to 35 percent in the substratum.

The Ap horizon has chroma of 2 or 3. The A horizon, where it occurs, has value and chroma of 2 or 3. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma or 4 to 6. It is sandy loam, loam, sandy clay loam, or clay loam. The 2C horizon is sandy loam, gravelly sandy loam, loam, gravelly loam, cobbly sandy loam, or cobbly loam.

## Scott Lake Series

The Scott Lake series consists of deep, moderately well drained soils on outwash plains and stream terraces. These soils formed in loamy deposits or in silty and loamy deposits and in the underlying sand to very gravelly coarse sand. Permeability is moderate in the subsoil and rapid in the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Scott Lake sandy loam, 0 to 3 percent slopes, 4,100 feet west and 50 feet south of the northeast corner of sec. 6, T. 26 N., R. 9 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common fine roots; about 5 percent gravel; slightly acid; abrupt smooth boundary.

E/B—8 to 15 inches; 70 percent brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry (E); weak medium platy structure parting to moderate very fine subangular blocky; friable; dark brown (7.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; few fine roots; about 5 percent gravel; slightly acid; gradual wavy boundary.

B/E—15 to 22 inches; 70 percent dark brown (7.5YR 4/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; few fine roots; few clay coatings on sand grains; tongues of brown (10YR 5/3) sandy loam (E); about 5 percent gravel; strongly acid; gradual wavy boundary.

Bt1—22 to 29 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; clay coatings on most sand grains; interfingering of brown (10YR 5/3) sandy loam (E); about 5 percent gravel; strongly acid; clear wavy boundary.

2Bt2—29 to 33 inches; strong brown (7.5YR 5/6) loamy sand; common medium distinct yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; very friable; few fine roots; few clay bridges between sand grains; about 10 percent gravel; medium acid; clear wavy boundary.

2C—33 to 60 inches; light yellowish brown (10YR 6/4) gravelly coarse sand; common medium prominent strong brown (7.5YR 5/8) mottles; single grain; loose; about 25 percent gravel; slightly acid.

The thickness of the solum ranges from 24 to 40 inches. The thickness of the silty or loamy deposits ranges from 20 to 36 inches. The content of gravel ranges from 0 to 15 percent in the upper part of the solum, from 2 to 35 percent in the lower part of the solum, and from 10 to 60 percent in the substratum. The content of cobbles ranges from 0 to 5 percent in the upper part of the solum and from 0 to 25 percent in the lower part and in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Ap or A horizon is sandy loam or silt loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam, loam, fine sandy loam, or sandy loam. The 2Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam, loamy sand, or the gravelly analogs of these textures. The 2C horizon is sand, coarse sand, or the gravelly or very gravelly analogs of these textures.

## Seelyeville Series

The Seelyeville series consists of deep, very poorly drained soils in depressions on ground moraines, glacial lake plains, and outwash plains. These soils formed in herbaceous organic material more than 51 inches thick. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Typical pedon of Seelyeville muck, 0 to 1 percent slopes, 500 feet west and 2,510 feet south of the northeast corner of sec. 12, T. 26 N., R. 9 E.

Oa1—0 to 4 inches; sapric material, black (10YR 2/1) broken face, very dark gray (10YR 3/1) rubbed; about 50 percent fiber, 15 percent rubbed; moderate thick platy structure; nonsticky; common fine roots; primarily herbaceous fibers; neutral (pH 6.9 in water); clear wavy boundary.

Oa2—4 to 10 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 20 percent fiber, 3 percent rubbed; moderate medium subangular blocky structure; slightly sticky; few fine roots; primarily herbaceous fibers; slightly acid (pH 6.5 in water); clear wavy boundary.

Oa3—10 to 20 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; moderate coarse

subangular blocky structure; nonsticky; primarily herbaceous fibers; about 3 percent woody fragments 1 inch in diameter and 1 to 3 inches in length; slightly acid (pH 6.5 in water); clear wavy boundary.

Oa4—20 to 41 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; moderate coarse subangular blocky structure; nonsticky; primarily herbaceous fibers; about 8 percent woody fragments 1 inch in diameter and 1 to 6 inches in length; neutral (pH 6.9 in water); clear wavy boundary.

Oa5—41 to 60 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; massive; nonsticky; primarily herbaceous fibers; about 8 percent woody fragments 1 inch in diameter and 1 to 6 inches in length; neutral (pH 7.1 in water).

The organic material is more than 51 inches thick. It has value of 2 or 3 and chroma of 1 or 2 throughout.

## Sherry Series

The Sherry series consists of deep, poorly drained and very poorly drained soils in depressions and drainageways on ground moraines. These soils formed in silty deposits underlain by loamy glacial till or in loamy residuum derived from igneous and metamorphic rock, or in both. Permeability is moderately slow or moderate in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Sherry silt loam, 0 to 3 percent slopes, 1,500 feet north and 100 feet west of the southeast corner of sec. 25, T. 30 N., R. 8 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; few fine prominent dark brown (7.5YR 4/4) mottles; moderate medium granular structure; friable; many fine roots; about 1 percent gravel; very strongly acid; clear wavy boundary.

A2—4 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; few fine prominent dark brown (7.5YR 4/4) mottles; moderate very fine subangular blocky structure; friable; common fine roots; about 1 percent gravel; very strongly acid; clear wavy boundary.

Eg—8 to 13 inches; light brownish gray (2.5Y 6/2) silt loam; common fine prominent dark brown (7.5YR 4/4) mottles; weak medium platy structure parting to moderate very fine subangular blocky; friable; few fine roots; about 5 percent gravel; common fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); very strongly acid; clear wavy boundary.

BEg—13 to 18 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; few fine roots; about 5 percent gravel; few fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); very strongly acid; clear wavy boundary.

Btg—18 to 26 inches; grayish brown (10YR 5/2) silt loam; common medium prominent yellowish red (5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; friable; few fine roots; about 1 percent gravel; common distinct dark gray (10YR 4/1) clay films on vertical faces of peds; very strongly acid; clear wavy boundary.

2Bt—26 to 38 inches; brown (7.5YR 5/4) loam; common medium distinct yellowish red (5YR 5/6) and many medium distinct brown (7.5YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; about 2 percent gravel; few distinct dark gray (10YR 4/1) clay films on vertical faces of peds; very strongly acid; clear wavy boundary.

2BC—38 to 44 inches; dark brown (7.5YR 4/4) loam; common medium distinct yellowish red (5YR 5/6) and brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; firm; about 5 percent gravel; strongly acid; clear wavy boundary.

3C—44 to 60 inches; yellowish brown (10YR 5/6), grayish brown (2.5Y 5/2), light olive brown (2.5Y 5/4), and yellowish red (5YR 5/8) loam; massive; firm; about 5 percent gravel; medium acid.

The thickness of the solum ranges from 30 to 60 inches. The thickness of the silty deposits ranges from 15 to 30 inches. The content of gravel ranges from 0 to 5 percent in the upper part of the solum and from 5 to 35 percent in the lower part and in the substratum. The content of cobbles ranges from 0 to 5 percent in the upper part of the solum and from 0 to 10 percent in the lower part and in the substratum.

The A horizon or the Ap horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. The Eg, BEg, and Btg horizons have hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. They are silt loam or silty clay loam. The 2Bt horizon has hue of 5Y, 2.5Y, 10YR, 7.5YR, 5YR, or 2.5YR; value of 4 or 5; and chroma of 2 to 8. It is loam, sandy loam, sandy clay loam, clay loam, or the gravelly analogs of these textures. The 3C horizon has textures similar to those of the 2Bt horizon.

## Sturgeon Series

The Sturgeon series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in silty, loamy, and sandy alluvial deposits. Permeability is moderate in the silty and loamy upper part of the profile and rapid in the sandy lower part. Slope ranges from 0 to 2 percent.

These soils have more sand in the lower part of the control section and have yellower hue than is defined as the range for the Sturgeon series. These differences, however, do not affect the usefulness or behavior of the soils.

Typical pedon of Sturgeon silt loam, 0 to 2 percent slopes, 1,250 feet south and 1,750 feet west of the northeast corner of sec. 31, T. 30 N., R. 5 E.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common fine roots; about 2 percent gravel; strongly acid; clear wavy boundary.

C1—8 to 18 inches; dark yellowish brown (10YR 3/4) silt loam; weak very fine subangular blocky structure; friable; few fine roots; about 3 percent gravel; strongly acid; clear wavy boundary.

C2—18 to 31 inches; dark brown (7.5YR 3/4), stratified silt loam, loam, and sandy loam; few fine distinct dark grayish brown (10YR 4/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; about 3 percent gravel; strongly acid; abrupt wavy boundary.

C3—31 to 41 inches; dark yellowish brown (10YR 4/4) sand; common medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; about 5 percent gravel; strongly acid; clear wavy boundary.

C4—41 to 60 inches; brown (10YR 5/3) sand; single grain; loose; about 10 percent gravel; strongly acid.

The thickness of the silty and loamy mantle ranges from 16 to 36 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon or the Ap horizon, where it occurs, has hue of 10YR or 7.5YR and value and chroma of 2 or 3. The part of the C horizon within a depth of about 36 inches is silt loam, loam, fine sandy loam, or sandy loam. Stratification of these textures or with coarser ones is common. The lower part of the C horizon is sand, fine sand, loamy sand, or loamy fine sand. Stratification of these textures or with finer ones is common.

## Withee Series

The Withee series consists of deep, somewhat poorly drained soils on ground moraines. These soils formed in silty deposits and in the underlying loamy glacial till. Permeability is moderate in the silty upper part of the profile and very slow in the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Withee silt loam, 0 to 3 percent slopes, 1,800 feet north and 1,675 feet east of the southwest corner of sec. 7, T. 27 N., R. 2 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

E—8 to 13 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; few fine faint grayish brown (10YR 5/2) and common medium prominent strong brown (7.5YR 5/6) mottles; weak thick platy structure parting to moderate fine subangular blocky; friable; few fine roots; strongly acid; clear wavy boundary.

E/B—13 to 25 inches; 80 percent brown (10YR 5/3) silt loam (E); many coarse faint grayish brown (10YR 5/2) and common medium prominent strong brown (7.5YR 5/6) mottles; weak very thick platy structure parting to moderate medium subangular blocky; friable; dark brown (7.5YR 4/4) silt loam (Bt); few fine roots; very strongly acid; gradual wavy boundary.

B/E—25 to 32 inches; 70 percent dark brown (7.5YR 4/4) loam (Bt); many coarse distinct grayish brown (10YR 5/2) and common medium prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; few faint discontinuous reddish brown (5YR 4/4) clay films on horizontal faces of peds (Bt); tongues of brown (10YR 5/3) silt loam (E); very strongly acid; clear wavy boundary.

2Bt1—32 to 39 inches; reddish brown (5YR 4/4) clay loam; common fine distinct pinkish gray (5YR 6/2) and common medium prominent yellowish red (5YR 5/8) mottles; moderate medium prismatic structure parting to strong coarse subangular blocky; firm; common faint discontinuous reddish brown (5YR 4/3) clay films on all faces of peds; about 5 percent gravel; very strongly acid; clear wavy boundary.

2Bt2—39 to 45 inches; reddish brown (5YR 4/4) sandy clay loam; few medium prominent yellowish red (5YR 5/8) mottles; moderate coarse subangular

blocky structure; firm; few faint discontinuous reddish brown (5YR 4/3) clay films on vertical faces of peds; about 10 percent gravel; very strongly acid; gradual wavy boundary.

Cd—45 to 60 inches; reddish brown (5YR 4/4) sandy clay loam; massive; firm; about 10 percent gravel; very strongly acid.

The thickness of the solum ranges from 32 to 45 inches. The thickness of the silty deposits ranges from 15 to 36 inches. The content of gravel ranges from 0 to 5 percent in the silty deposits and from 0 to 15 percent in the underlying loamy till.

The Ap horizon has value and chroma of 2 or 3. The A horizon, where it occurs, has value of 2 or 3 and chroma of 1 or 2. Some pedons have a Bt horizon. This horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam. The 2Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. This horizon has mottles with chroma of 2 to 8. It is loam, sandy clay loam, or clay loam. The 2Cd horizon has textures similar to those of the 2Bt horizon.

# Formation of the Soils

This section describes the geology and underlying material in Marathon County, the processes of soil formation, and the factors of soil formation.

## Geology and Underlying Material

Robert N. Cheetham, geologist, Natural Resources Conservation Service, and John W. Attig, Jr., geologist, Wisconsin Geological and Natural History Survey, helped prepare this section.

Marathon County, within the Northern Highland of Wisconsin, is underlain by a variety of Precambrian igneous, volcanic, and metamorphic rocks *(11)*. In about 5 percent of the area, mostly in the southwestern and southern parts of the county, the Precambrian rock is overlain by Upper Cambrian sandstone. Both the Precambrian and Upper Cambrian rocks are quarried for dimension stone. A distinctive red granite is quarried in several areas, and well cemented Upper Cambrian sandstone is quarried at a few sites. The Precambrian rock has been weathered to a considerable depth in many areas of the county. The weathered, coarse grained, red granite, locally called "rotten granite," is extensively used in county road maintenance and landscaping. The two most conspicuous landforms are Rib Mountain, a monadnock of quartzite, and the valley of the Wisconsin River.

The Precambrian and Upper Cambrian rock is overlain by as much as 260 feet of Pleistocene material *(12)*. The thickest Pleistocene deposits occur in the valleys of the Wisconsin, Rib, Eau Pleine, and Plover Rivers. In these valleys the streams marginal to and draining from the Pleistocene glaciers deposited thick sequences of stratified sand and gravelly sand. These are locally overlain by thin deposits of postglacial alluvium or windblown silt. The sand and gravelly sand deposited by meltwater streams is mined in many areas. The extent of these outwash deposits coincides generally with associations 7, 8, and 9, which are described in the section "General Soil Map Units."

Glacial materials were deposited by the Chippewa and Western Green Bay ice lobes during the Pleistocene epoch. The stratigraphic sequence of glacial formational units is complex, and it is based on the mineralogical, chemical, and physical characteristics of till assemblages and associated alluvial and lacustrine deposits. The oldest till deposited is the Wausau Member of the Marathon Formation. It is probably of pre-Wisconsinan age. It is in the central part of the county. This till and the associated sand and gravel, which were deposited by a glacial advance from the west-northwest, form a discontinuous cover, generally less than 10 feet thick, over the bedrock. Glacial erratics throughout the area provide clear evidence of glaciation. Adjacent to the major drainageways, the thin deposits of glacial materials have been eroded and the underlying Precambrian rock crops out. The area of this till generally coincides with associations 4, 5, and 6.

A glacial deposit of intermediate age, the Edgar Member of the Marathon Formation, overlies the Wausau Member. This till, deposited by an advance of ice from the northwest, is reddish brown to pinkish gray loam, sandy loam, sandy clay loam, or clay loam. It is calcareous but has been leached to depths of at least 10 feet. The extent of the Edgar Member is approximately defined by association 2.

Another glacial deposit of intermediate age was transported from the north in early Wisconsinan or pre-Wisconsinan times. This deposit is reddish brown sandy loam till and is in the northern part of the county. This stratigraphic unit is the Merrill Member of the Lincoln Formation. The till is as much as 200 feet thick. Its extent generally coincides with association 1.

The most recent glacial stratigraphic unit in Marathon County, the Mapleview Member of the Horicon Formation, is late Wisconsinan in age. The till is reddish brown or brown sandy loam or loamy sand. It occurs in the eastern part of the county and was deposited by the Western Green Bay ice lobe. Because this area was the most recently glaciated in Marathon County, the landforms are well preserved and undrained depressions are common. The extent of this area generally coincides with association 3.

## Processes of Soil Formation

Horizons are differentiated in a soil as a result of the action of certain basic soil-forming processes.

There are four main processes. They are gains, losses, transfers, and transformations. They generally do not act alone. Some changes promote and others retard or offset horizon differentiation. The balance among the changes determines the nature of the soil at any given point.

Withee soils exemplify how these soil-forming processes interact. The parent material of these soils was acid loamy till and windblown silt loam. The silt loam was probably deposited over the till during and after the glacial period. Because these soils are nearly level and gently sloping and are underlain by nonporous till, they are somewhat poorly drained. The climate favored the growth of plants. Plants and animals contributed to the accumulation of organic matter and organic acids and mixed the soil. These processes accelerated as more and higher forms of organisms grew in the soils and produced more organic residue and acids.

Organic matter in various stages of decomposition accumulated on or near the surface. Decomposed organic matter gave the surface layer a darker color than it originally had. Suspended particles of clay were translocated downward in the soils by slowly percolating water. The chemical weathering of minerals and the accumulation of clay gradually changed the middle part of the soil profile to clay loam. Periodic wetting and drying in the upper part of the soils caused oxidation and reduction of the iron in the subsurface layer and subsoil. This process gave these horizons a mottled color.

As a result of these processes, the Withee soils have a very dark grayish brown silt loam surface layer, a mottled silt loam subsurface layer, and a mottled loam, clay loam, and sandy clay loam subsoil. They are underlain by acid sandy clay loam glacial till at a depth of about 45 inches. This underlying till has changed little since it was deposited.

Processes that took place in the formation of Withee soils were gains of organic matter in the surface layer, loss of clay in the subsurface layer and the subsequent transfer of clay to the subsoil, and the transformation of iron compounds in the subsurface layer and subsoil. All of these processes are active in the soils of Marathon County. The kinds of parent material in Marathon County together with the relief have, to a great extent, determined the kinds of processes that are dominant in the formation of all the soils. These processes are, in turn, largely responsible for the differences and similarities among the soils.

## Factors of Soil Formation

The factors that determine the kind of soil that forms at any given point are the composition of the parent material; the climate under which the soil material has accumulated and weathered; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material *(8)*.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They alter the accumulated parent 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 affects the kind of profile that can form and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of 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

Parent material is the unconsolidated mass in which a soil forms. It largely determines the chemical and mineralogical composition of the soil. All of the soils in Marathon County formed in deposits that are directly or indirectly the result of glacial action. Some soils formed in more than one kind of parent material. Many have a silty mantle of eolian origin.

Most of the soils in Marathon County formed partially in glacial till or glacial outwash. Many formed in residuum derived from the underlying igneous or metamorphic bedrock or have this locally derived residuum mixed into the till. A few soils formed in glaciolacustrine deposits, alluvial deposits, or organic material.

Glacial till is unstratified, unsorted glacial debris consisting of clay, silt, and sand. It may contain gravel, cobbles, stones, or boulders. There were three or more glacial advances into Marathon County. These are distinguished primarily by the textures of the till and the amount of locally derived residuum mixed with the till.

Hatley and Kennan soils formed in the youngest till. They formed in a silty or loamy mantle over till that is typically loamy sand.

Amery, Cable, Freeon, and Magnor are examples of soils that formed in till of intermediate age. They

formed in a silty or loamy mantle over till that is typically gravelly sandy loam.

The oldest till contains varying amounts of residuum derived locally from the underlying bedrock. Rozellville and Sherry soils formed in silty and loamy deposits over mixed loamy till and residuum. Fenwood and Rietbrock soils formed in silty deposits and in the underlying mixed loamy till and residuum. Undifferentiated igneous and metamorphic bedrock is within 5 feet of the surface of these soils. Marathon, Moberg, and Mylrea soils formed in silty and loamy deposits over extremely gravelly residuum known as grus. Dancy, Guenther, Meadland, Mosinee, and Rockers soils formed in loamy or sandy deposits over mixed loamy glacial till and residuum. Mosinee soils are underlain by undifferentiated igneous and metamorphic bedrock within 5 feet of the surface. Altdorf and Dolph soils formed in silty deposits over mixed clayey glacial till and residuum. Ribhill soils formed in silty deposits over quartzite bedrock.

Glacial outwash was deposited by meltwater flowing from glacial ice. It occurs as sandy and gravelly deposits that are commonly stratified. This material is adjacent to the major streams throughout the county and on pitted outwash and outwash plains in the eastern part of the county. Chetek, Minocqua, Oesterle, Rosholt, and Scott Lake soils formed in silty or loamy deposits and in the underlying sand and gravel. Meehan and Newson soils formed in sandy outwash. Mahtomedi soils formed in sandy and gravelly outwash.

Glaciolacustrine deposits are in glacial lake basins or on plains. They were exposed when water levels dropped or the elevation of the land rose. Alban and Plover soils formed in stratified, loamy lacustrine deposits. Graycalm soils formed mostly in sandy deposits.

Organic material consists mainly of sedges, reeds, grasses, and woody fragments in varying stages of decomposition. Greenwood and Seelyeville soils formed in more than 51 inches of organic material. Cathro soils formed in organic material 16 to 51 inches deep over silty and loamy deposits.

Alluvial deposits are of recent origin. They were deposited on stream bottoms by floodwater. The soils that formed in alluvium generally do not have distinct horizons. They generally vary in texture. Dunnville, Fordum, and Sturgeon soils formed in alluvial deposits.

### Climate

Precipitation and temperature affect soil formation. They have a direct effect on the weathering of rock and the alteration of the parent material. The weathering and alteration occur through the mechanical action of freezing and thawing and the chemical action generated by the leaching of water.

Differences in climate within the county are too small to have had any great effect on the differences among the soils. Marathon County has a humid-temperate continental climate that favors the growth of trees.

### Plant and Animal Life

Plant and animal life, which includes trees, shrubs, grasses, fungi, bacteria, earthworms, rodents, and humans, affect soil formation. These living organisms supply organic matter, mix the soil horizons, bring nutrients up from the lower horizons, and improve the movement of air and water through the soil.

The influence of vegetation on the characteristics of soils is shown by the differences in color between soils that formed under trees and those that formed under grass. Most of the soils in Marathon County formed under trees. These soils have a lighter colored or a thinner surface layer and are generally more acid than the soils that formed under grass.

Human activities have influenced the soils by disturbing and altering the natural soil-forming processes. These activities may be beneficial or destructive. In some areas removal of the plant cover has accelerated erosion, and in others bare soils have been stabilized by a plant cover. Cultivation has mixed the upper soil horizons, and applications of fertilizer and lime have altered the fertility and reaction of the soils. Cropping practices have resulted in gains or losses in organic matter. The natural drainage of the soils has been changed by the installation of various types of drains and the construction of building structures. These activities in turn have changed the kinds of vegetation.

### Relief

Relief affects a number of soil properties. These properties include the thickness of the solum, the thickness and organic matter content of the surface layer, drainage, color, horizon differentiation, reaction, temperature, and nature of the original material. The present-day relief of Marathon County is determined both by glacial deposits and by the underlying bedrock.

The surface layer of sloping and steeper soils tends to be thinner and lighter colored than that of the less sloping soils. Normally, such soils are well drained, exhibit mottle-free colors, have fewer horizons than the less sloping soils and are less well developed, vary in

reaction, and have soil temperatures that vary with the slope aspect. Some of these features are related to the smaller amount of water that moves through the profile because of increased runoff.

Where runoff accumulates in depressions and nearly level areas, the soils become saturated at various depths for various lengths of time. For example, the Rosholt soils are well drained and are free of the mottles caused by saturation to a depth of at least 5 feet. In the gently sloping and nearly level Scott Lake soils, reddish mottles are at a depth of 3 to 5 feet because of saturation for short periods. The nearly level Oesterle soils are saturated at a depth of 1 to 3 feet and have gray mottles because of longer periods of saturation. The Minocqua soils, which are in the lowest areas on the landscape, are dominantly gray because they have been saturated at or near the surface for long periods. Generally, these saturated soils develop a thicker and darker surface layer than do unsaturated soils. The excess water stimulates plant growth and results in a subsequent accumulation of organic matter that exceeds the rate of decomposition.

The thickness of the solum and the differentiation of horizons also are related to relief. The sloping to steep Fenwood soils commonly have a thinner solum and exhibit less subsoil development than do the gently sloping Fenwood soils.

**Time**

Time modifies the effects of the other soil-forming factors. The longer the factors have interacted, the more highly developed or mature the soil is.

Probably the youngest soils in Marathon County are the Fordum soils. These soils are in depressions, in overflow channels, and on flood plains along rivers. They may exhibit some layering of materials but little, if any, subsoil development. This condition exists because these materials have been in place only for a short time, are often reworked by the streams or rivers, and periodically receive deposits of new material.

Probably the oldest soils in the county are the Meadland soils. These soils are on ground moraines, mainly in the south-central part of the county. They formed in loamy deposits over loamy glacial till that is at least 40,000 years old. These soils exhibit distinct profile development.

# References


(1) American Association of State Highway and Transportation Officials. 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition.

(2) American Society for Testing and Materials. 1993. Standard test method for classification of soils for engineering purposes. ASTM Standard D 2487.

(3) Bell, E.A., and M.G. Sherrill. 1974. Water availability in central Wisconsin—an area of near-surface crystalline rock. Geological Survey Water-Supply Paper 2022.

(4) Carlson, Harland, and Lloyd M. Andrews. 1977. Surface water resources of Marathon County. Wisconsin Department of Natural Resources.

(5) Devaul, R.W., and J.H. Green. 1971. Water resources of Wisconsin—central Wisconsin River basin. U.S. Department of the Interior, Geological Survey Hydrology Investigations Atlas HA-367.

(6) Geib, W.J., and others. 1917. Reconnaissance soil survey of south part of north central Wisconsin. Wisconsin Geological and Natural History Survey.

(7) Hahn, Jerold T. 1985. Timber resource of Wisconsin's central survey unit, 1983. U.S. Department of Agriculture, Forest Service, Resources Bulletin NC-84.

(8) Jenny, Hans. 1941. Factors of soil formation.

(9) Klingelhoets, A.J., and M.I. Beatty. 1966. What yields from Wisconsin soils. University of Wisconsin Extension Service, Special Circular 65.

(10) Klueter, Howard R., and James J. Lorence. 1977. Woodlot and ballot box, Marathon County in the twentieth century.

(11) LaBerge, Gene L., and Paul E. Myers. 1983. Precambrian geology of Marathon County, Wisconsin. University of Wisconsin Extension, Geological and Natural History Survey Information Circular 45.

(12) Mickelson, D.M., and others. 1984. Pleistocene stratigraphic units of Wisconsin. University of Wisconsin Extension, Geological and Natural History Survey Miscellaneous Paper 84-1.

(13) United States Department of Agriculture. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

(14) United States Department of Agriculture. 1993. Soil survey manual. U.S. Department of Agriculture Handbook 18.

(15) United States Department of Agriculture. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd Edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436.

(16) Whitson, A.R., T.J. Dunnewald, and Carl Thompson. 1921. Soil survey of northern Wisconsin. Wisconsin Geological and Natural History Survey.

(17) Wisconsin Agriculture Reporting Service. 1983. 1983 Wisconsin agricultural statistics.

# Glossary

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Argillic horizon.** A subsoil horizon characterized by an accumulation of illuvial clay.

**Association, soil.** A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

| | |
|---|---|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Moderate | 6 to 9 |
| High | 9 to 12 |
| Very high | more than 12 |

**Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

**Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.

**Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

**Chisel planting.** Seedbed preparation by chiseling without inversion of the soil, leaving a protective cover of crop residue on the surface for erosion control.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

**Clayey soil material.** Clay, silty clay, or sandy clay.

**Coarse fragments.** If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles 15 to 38 centimeters (6 to 15 inches) long.

**Coarse textured soil.** Sand or loamy sand.

**Cobblestone (or cobble).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

**Complex slope.** Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

**Complex, soil.** A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

**Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.
*Cemented.*—Hard; little affected by moistening.

**Contour stripcropping.** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

**Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

**Corrosive.** High risk of corrosion to uncoated steel or deterioration of concrete.

**Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

**Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.

**Deep to water** (in tables). Deep to the permanent water table during the dry part of the year. Typically, the depth to the water table is more than 5 feet.

**Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.

**Depth, soil.** The thickness of the soil over bedrock. In this survey the depth classes are *deep*, more than 40 inches; *moderately deep*, 20 to 40 inches; and *shallow*, 10 to 20 inches.

**Depth to rock** (in tables). Bedrock is too near the surface for the specified use.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class** (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
*Excessively drained.*—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
*Somewhat excessively drained.*—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
*Well drained.*—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
*Moderately well drained.*—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
*Somewhat poorly drained.*—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
*Poorly drained.*—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
*Very poorly drained.*—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**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.

**Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

**Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

**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** (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

**Fast intake** (in tables). The rapid movement of water into the soil.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Fibric soil material (peat).** The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

**Frost action** (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

**Genesis, soil.** The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

**Glacial drift** (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

**Glacial outwash** (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

**Glacial till** (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

**Glaciofluvial deposits** (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

**Glaciolacustrine deposits.** Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

**Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

**Granite.** An equigranular, light colored igneous rock that has quartz as a dominant mineral and includes feldspar and mica.

**Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

**Gravel.** Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

**Gravelly soil material.** Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

**Green manure crop** (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

**Ground water** (geology). Water filling all the unblocked pores of underlying material below the water table.

**Grus.** An accumulation of angular, coarse grained fragments resulting from the granular disintegration of crystalline rocks. Commonly known as rotten granite.

**Hemic soil material (mucky peat).** Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

**Hill.** A natural elevation of the land surface that has a slope of 10 percent or more.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics

produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

*O horizon.*—An organic layer of fresh and decaying plant residue.

*A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

*E horizon.*—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

*B horizon.*—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

*Cd horizon.*—Dense, unconsolidated deposits or material that has high bulk density; for example, basal till.

*Cr horizon.*—Soft, consolidated bedrock beneath the soil.

*R layer.*—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Igneous rock.** Rock formed by the solidification of molten material that originated deep within the earth.

**Illuviation.** The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration 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.

**Knoll.** A natural elevation of the land surface that has a slope of less than 10 percent.

**Lacustrine deposit** (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

**Lamellae.** Thin, horizontal bands or layers of accumulated clayey material, generally less than 2 centimeters thick.

**Large stones** (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.

**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Loamy soil material.** Clay loam, sandy clay loam, loam, very fine sandy loam, fine sandy loam, or sandy loam.

**Loess.** Fine grained material, dominantly of silt-sized particles, deposited by wind.

**Low strength.** The soil is not strong enough to support loads.

**Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.

**Metamorphic rock.** Rock of any origin altered in mineralogical composition, chemical composition,

or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

**Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

**Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.

**Miscellaneous area.** An area that has little or no natural soil and supports little or no vegetation.

**Moderately coarse textured soil.** Coarse sandy loam, sandy loam, and fine sandy loam.

**Monadnock.** A prominent hill or isolated mountain that rises conspicuously above the surrounding area.

**Moraine** (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

**Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

**Muck.** Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

**Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition. The content of organic matter is expressed as:

| | |
|---|---|
| Very low | less than 0.5 percent |
| Low | 0.5 to 1.0 percent |
| Moderately low | 1.0 to 2.0 percent |
| Moderate | 2.0 to 4.0 percent |
| High | 4.0 to 8.0 percent |
| Very high | more than 8.0 percent |

**Organic soil.** A soil in which the content of organic carbon is 12 to 18 percent or more, depending on the content of mineral material. The organic layer is more than 16 inches thick.

**Outwash plain.** A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Peat.** Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

**Pebble.** See Gravel.

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percolation.** The movement of water through the soil.

**Percs slowly** (in tables). The slow movement of water through the soil, adversely affecting the specified use.

**Permeability.** The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

| | |
|---|---|
| Very slow | less than 0.06 inch |
| Slow | 0.06 to 0.2 inch |
| Moderately slow | 0.2 to 0.6 inch |
| Moderate | 0.6 inch to 2.0 inches |
| Moderately rapid | 2.0 to 6.0 inches |
| Rapid | 6.0 to 20 inches |
| Very rapid | more than 20 inches |

**Phase, soil.** A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

**pH value.** A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

**Piping** (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

**Pitted outwash.** An outwash area characterized by many irregular depressions, such as kettles, shallow pits, and potholes.

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**Ponding.** Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**Poor filter** (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

**Poorly graded.** Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Profile, soil.** A vertical section of the soil extending through all its horizons.

**Quartzite.** A compact, granular rock composed of quartz that is metamorphosed sandstone.

**Reaction, soil.** A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

| | |
|---|---|
| Extremely acid | below 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Medium acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Mildly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Residuum (residual soil material).** Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

**Ridge.** A linear knoll or hill.

**Rill.** A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

**Rippable.** Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

**Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

**Rooting depth** (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

**Root zone.** The part of the soil that can be penetrated by plant roots.

**Rotten granite.** Common term used to describe gravelly material (grus) that is excavated from pits and used as roadbase or fill.

**Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sandstone.** Sedimentary rock containing dominantly sand-size particles.

**Sandy soil material.** Loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, very fine sand, fine sand, sand, or coarse sand.

**Sapric soil material (muck).** The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

**Sedimentary rock.** Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Series, soil.** A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

**Sheet erosion.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Shrink-swell.** The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

**Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Silty soil material.** Silt, silt loam, or silty clay loam.

**Similar soils.** Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or

management requirements for the major land uses in the survey area.

**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 the following slope classes (by percentage) are recognized:

| | |
|---|---|
| Nearly level | 0 to 2 |
| Gently sloping or undulating | 2 to 6 |
| Sloping or rolling | 6 to 12 |
| Moderately steep or hilly | 12 to 20 |
| Steep or very hilly | 20 to 30 |
| Very steep | More than 30 |

**Slope** (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**Small stones** (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

**Soil.** A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates.** Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

| | |
|---|---|
| Very coarse sand | 2.0 to 1.0 |
| Coarse sand | 1.0 to 0.5 |
| Medium sand | 0.5 to 0.25 |
| Fine sand | 0.25 to 0.10 |
| Very fine sand | 0.10 to 0.05 |
| Silt | 0.05 to 0.002 |
| Clay | less than 0.002 |

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Subsides (in tables).** The settlement of organic soils or soils containing semifluid layers.

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Surface soil.** The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

**Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

**Terminal moraine.** A belt of thick glacial drift that generally marks the termination of important glacial advances.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic

textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Thin layer** (in tables). Otherwise suitable soil material too thin for the specified use.

**Tiers.** Layers in the control section of organic soils. The organic material is divided into three tiers. The surface tier is the upper 12 inches; the subsurface tier is the next 24 inches; and the bottom tier is the lower 16 inches.

**Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

**Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Upland** (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Weathering.** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

**Well graded.** Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

# Tables

**Table 1.--Temperature and Precipitation**

**(Recorded in the period 1951-81 at Wausau, Wisconsin)**

| Month | Temperature | | | | | | Precipitation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2 years in 10 will have-- | | | | 2 years in 10 will have-- | | | |
| | Average daily maximum | Average daily minimum | Average daily | Maximum temperature higher than-- | Minimum temperature lower than-- | Average number of growing degree days* | Average | Less than-- | More than-- | Average number of days with 0.10 inch or more | Average snowfall |
| | °F | °F | °F | °F | °F | Units | In | In | In | | In |
| January | 20.6 | 1.9 | 11.3 | 44 | -28 | 0 | 0.90 | 0.30 | 1.39 | 3 | 10.6 |
| February | 26.5 | 5.6 | 16.1 | 48 | -24 | 0 | 1.01 | .27 | 1.60 | 3 | 9.7 |
| March | 36.9 | 17.6 | 27.3 | 64 | -15 | 0 | 1.85 | .68 | 2.82 | 5 | 10.9 |
| April | 53.5 | 32.9 | 43.2 | 83 | 13 | 21 | 2.92 | 1.70 | 4.00 | 7 | 2.6 |
| May | 66.9 | 43.8 | 55.4 | 89 | 26 | 218 | 3.73 | 2.33 | 4.99 | 8 | .2 |
| June | 75.8 | 53.4 | 64.6 | 92 | 36 | 438 | 3.95 | 2.15 | 5.53 | 8 | .0 |
| July | 80.3 | 58.4 | 69.4 | 94 | 45 | 601 | 3.95 | 2.38 | 5.34 | 7 | .0 |
| August | 77.8 | 56.4 | 67.1 | 93 | 40 | 530 | 4.14 | 2.49 | 5.61 | 8 | .0 |
| September | 68.0 | 47.3 | 57.7 | 89 | 29 | 236 | 3.87 | 1.69 | 5.72 | 8 | .0 |
| October | 56.9 | 37.4 | 47.2 | 81 | 19 | 81 | 2.29 | .79 | 3.51 | 5 | .2 |
| November | 39.8 | 24.5 | 32.2 | 65 | 0 | 0 | 1.75 | .58 | 2.71 | 4 | 5.1 |
| December | 26.3 | 10.3 | 18.3 | 48 | -20 | 0 | 1.25 | .57 | 1.82 | 5 | 11.2 |
| Yearly: | | | | | | | | | | | |
| Average | 52.4 | 32.5 | 42.5 | --- | --- | --- | --- | --- | --- | --- | --- |
| Extreme | --- | --- | --- | 95 | -29 | --- | --- | --- | --- | --- | --- |
| Total | --- | --- | --- | --- | --- | 2,125 | 31.61 | 27.03 | 36.01 | 71 | 50.5 |

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

**Table 2.--Freeze Dates in Spring and Fall**

**(Recorded in the period 1951-81 at Wausau, Wisconsin)**

| Probability | Temperature | | |
|---|---|---|---|
| | 24 °F or lower | 28 °F or lower | 32 °F or lower |
| Last freezing temperature in spring: | | | |
| 1 year in 10 later than-- | Apr. 30 | May 12 | May 23 |
| 2 years in 10 later than-- | Apr. 26 | May 7 | May 18 |
| 5 years in 10 later than-- | Apr. 18 | Apr. 28 | May 9 |
| First freezing temperature in fall: | | | |
| 1 year in 10 earlier than-- | Oct. 11 | Sept. 26 | Sept. 15 |
| 2 years in 10 earlier than-- | Oct. 16 | Oct. 1 | Sept. 19 |
| 5 years in 10 earlier than-- | Oct. 25 | Oct. 12 | Sept. 27 |

**Table 3.--Growing Season**

**(Recorded in the period 1951-81 at Wausau, Wisconsin)**

| Probability | Daily minimum temperature during growing season | | |
|---|---|---|---|
| | Higher than 24 °F | Higher than 28 °F | Higher than 32 °F |
| | Days | Days | Days |
| 9 years in 10 | 168 | 144 | 119 |
| 8 years in 10 | 175 | 151 | 126 |
| 5 years in 10 | 190 | 166 | 141 |
| 2 years in 10 | 205 | 180 | 156 |
| 1 year in 10 | 213 | 188 | 163 |

Table 4.--Acreage and Proportionate Extent of the Soils

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| AbB | Alban loam, 1 to 6 percent slopes | 1,583 | 0.2 |
| Ad | Altdorf mucky silt loam, 0 to 2 percent slopes | 470 | * |
| AmC | Amery silt loam, 5 to 15 percent slopes | 809 | 0.1 |
| CbA | Cable silt loam, 0 to 3 percent slopes, stony | 15,065 | 1.5 |
| Ch | Cathro muck, 0 to 1 percent slopes | 25,574 | 2.5 |
| CkA | Chetek sandy loam, 0 to 2 percent slopes | 2,279 | 0.2 |
| CkB | Chetek sandy loam, 2 to 6 percent slopes | 7,219 | 0.7 |
| CkC | Chetek sandy loam, 6 to 15 percent slopes | 4,725 | 0.5 |
| CkE | Chetek sandy loam, 15 to 30 percent slopes | 3,004 | 0.3 |
| Da | Dancy sandy loam, 0 to 2 percent slopes | 11,889 | 1.2 |
| DoA | Dolph silt loam, 0 to 3 percent slopes | 912 | 0.1 |
| DuB | Dunnville fine sandy loam, 1 to 4 percent slopes | 2,981 | 0.3 |
| FeC | Fenwood silt loam, 6 to 12 percent slopes | 19,193 | 1.9 |
| FeD | Fenwood silt loam, 12 to 20 percent slopes | 2,413 | 0.2 |
| FfC | Fenwood silt loam, 2 to 15 percent slopes, stony | 8,820 | 0.9 |
| FfE | Fenwood silt loam, 15 to 30 percent slopes, stony | 2,749 | 0.3 |
| FgB | Fenwood-Rozellville silt loams, 2 to 6 percent slopes | 81,745 | 8.1 |
| Fh | Fordum silt loam, 0 to 1 percent slopes | 21,078 | 2.1 |
| FnB | Freeon silt loam, 2 to 6 percent slopes | 32,777 | 3.2 |
| FnC | Freeon silt loam, 6 to 12 percent slopes | 3,941 | 0.4 |
| GcB | Graycalm loamy sand, 2 to 6 percent slopes | 2,206 | 0.2 |
| Gm | Graycalm loamy sand, moderately well drained, 0 to 2 percent slopes | 1,914 | 0.2 |
| Gr | Greenwood peat, 0 to 1 percent slopes | 5,647 | 0.6 |
| GuB | Guenther loamy sand, 2 to 6 percent slopes | 3,722 | 0.4 |
| HtB | Hatley silt loam, 1 to 6 percent slopes | 1,199 | 0.1 |
| HyB | Hatley cobbly silt loam, 1 to 6 percent slopes, bouldery | 9,507 | 0.9 |
| KaB | Kennan sandy loam, 2 to 8 percent slopes | 5,510 | 0.5 |
| KaC | Kennan sandy loam, 8 to 15 percent slopes | 6,392 | 0.6 |
| KaD2 | Kennan sandy loam, 15 to 30 percent slopes, eroded | 1,288 | 0.1 |
| KeB | Kennan sandy loam, 2 to 8 percent slopes, bouldery | 10,710 | 1.1 |
| KeC | Kennan sandy loam, 8 to 15 percent slopes, bouldery | 23,247 | 2.3 |
| KeE | Kennan sandy loam, 15 to 30 percent slopes, bouldery | 8,428 | 0.8 |
| LDF | Landfill | 127 | * |
| LoB | Loyal silt loam, 1 to 6 percent slopes | 84,451 | 8.4 |
| LoC | Loyal silt loam, 6 to 12 percent slopes | 1,132 | 0.1 |
| MaB | Magnor silt loam, 0 to 4 percent slopes | 36,667 | 3.6 |
| MbB | Mahtomedi loamy sand, 0 to 6 percent slopes | 23,789 | 2.4 |
| MbC | Mahtomedi loamy sand, 6 to 15 percent slopes | 2,064 | 0.2 |
| MbE | Mahtomedi loamy sand, 15 to 45 percent slopes | 2,258 | 0.2 |
| McA | Mahtomedi loamy sand, moderately well drained, 0 to 3 percent slopes | 10,259 | 1.0 |
| MdB | Marathon silt loam, 2 to 6 percent slopes | 15,003 | 1.5 |
| MdC | Marathon silt loam, 6 to 12 percent slopes | 2,269 | 0.2 |
| MeC | Marathon silt loam, 2 to 15 percent slopes, stony | 4,556 | 0.5 |
| MfA | Marshfield silt loam, 0 to 3 percent slopes | 40,440 | 4.0 |
| MgA | Meadland loam, 0 to 3 percent slopes | 24,241 | 2.4 |
| MhA | Meadland loam, 0 to 3 percent slopes, stony | 26,174 | 2.6 |
| Mm | Meehan loamy sand, 0 to 2 percent slopes | 5,426 | 0.5 |
| Mn | Minocqua sandy loam, 0 to 2 percent slopes | 6,652 | 0.7 |
| MoB | Moberg gravelly silt loam, 2 to 6 percent slopes | 2,654 | 0.3 |
| MoC | Moberg gravelly silt loam, 6 to 15 percent slopes | 3,802 | 0.4 |
| MsB | Mosinee sandy loam, 2 to 6 percent slopes | 19,030 | 1.9 |
| MsC | Mosinee sandy loam, 6 to 12 percent slopes | 3,065 | 0.3 |
| MsD | Mosinee sandy loam, 12 to 20 percent slopes | 829 | 0.1 |
| MtC | Mosinee sandy loam, 2 to 15 percent slopes, stony | 11,832 | 1.2 |
| MyB | Mylrea silt loam, 1 to 6 percent slopes | 11,220 | 1.1 |
| MzB | Mylrea silt loam, 1 to 6 percent slopes, stony | 9,901 | 1.0 |
| Ne | Newson mucky loamy sand, 0 to 1 percent slopes | 4,674 | 0.5 |
| Oe | Oesterle loam, 0 to 2 percent slopes | 11,057 | 1.1 |
| Pg | Pits, gravel | 3,404 | 0.3 |
| Ph | Pits, quarries | 249 | * |
| Po | Plover sandy loam, 0 to 2 percent slopes | 2,309 | 0.2 |

See footnote at end of table.

Table 4.--Acreage and Proportionate Extent of the Soils--Continued

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| RbC | Ribhill cobbly silt loam, 6 to 15 percent slopes, stony | 846 | 0.1 |
| RbE | Ribhill cobbly silt loam, 15 to 30 percent slopes, stony | 664 | 0.1 |
| RcB | Rietbrock silt loam, 1 to 8 percent slopes | 50,418 | 5.0 |
| ReB | Rietbrock silt loam, 1 to 8 percent slopes, stony | 24,467 | 2.4 |
| RhA | Rockers loamy sand, 0 to 3 percent slopes | 5,611 | 0.6 |
| RoA | Rosholt sandy loam, 0 to 2 percent slopes | 2,480 | 0.2 |
| RoB | Rosholt sandy loam, 2 to 6 percent slopes | 6,751 | 0.7 |
| RsA | Rosholt silt loam, 0 to 2 percent slopes | 1,492 | 0.1 |
| RsB | Rosholt silt loam, 2 to 6 percent slopes | 3,279 | 0.3 |
| ScA | Scott Lake sandy loam, 0 to 3 percent slopes | 6,281 | 0.6 |
| SdA | Scott Lake silt loam, 0 to 3 percent slopes | 2,909 | 0.3 |
| Se | Seelyeville muck, 0 to 1 percent slopes | 17,475 | 1.7 |
| ShA | Sherry silt loam, 0 to 3 percent slopes | 41,532 | 4.1 |
| St | Sturgeon silt loam, 0 to 2 percent slopes | 6,496 | 0.6 |
| UoB | Udorthents, loamy, gently sloping | 1,862 | 0.2 |
| UoE | Udorthents, loamy, steep (earthen dam) | 26 | * |
| WtA, WtB | Withee silt loam, 0 to 3 percent slopes | 114,065 | 11.3 |
| | Water | 23,584 | 2.3 |
| | Total | 1,008,768 | 100.0 |

* Less than 0.05 percent.

**Table 5.--Prime Farmland**

**(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)**

| Map symbol | Soil name |
|---|---|
| AbB | Alban loam, 1 to 6 percent slopes |
| DoA | Dolph silt loam, 0 to 3 percent slopes (where drained) |
| DuB | Dunnville fine sandy loam, 1 to 4 percent slopes |
| FgB | Fenwood-Rozellville silt loams, 2 to 6 percent slopes |
| FnB | Freeon silt loam, 2 to 6 percent slopes |
| HtB | Hatley silt loam, 1 to 6 percent slopes |
| KaB | Kennan sandy loam, 2 to 8 percent slopes |
| LoB | Loyal silt loam, 1 to 6 percent slopes |
| MaB | Magnor silt loam, 0 to 4 percent slopes |
| MdB | Marathon silt loam, 2 to 6 percent slopes |
| MfA | Marshfield silt loam, 0 to 3 percent slopes (where drained) |
| MgA | Meadland loam, 0 to 3 percent slopes (where drained) |
| MhA | Meadland loam, 0 to 3 percent slopes, stony (where drained) |
| MyB | Mylrea silt loam, 1 to 6 percent slopes |
| Oe | Oesterle loam, 0 to 2 percent slopes (where drained) |
| Po | Plover sandy loam, 0 to 2 percent slopes (where drained) |
| RcB | Rietbrock silt loam, 1 to 8 percent slopes |
| RhA | Rockers loamy sand, 0 to 3 percent slopes (where drained) |
| RoA | Rosholt sandy loam, 0 to 2 percent slopes |
| RoB | Rosholt sandy loam, 2 to 6 percent slopes |
| RsA | Rosholt silt loam, 0 to 2 percent slopes |
| RsB | Rosholt silt loam, 2 to 6 percent slopes |
| ScA | Scott Lake sandy loam, 0 to 3 percent slopes |
| SdA | Scott Lake silt loam, 0 to 3 percent slopes |
| ShA | Sherry silt loam, 0 to 3 percent slopes (where drained) |
| St | Sturgeon silt loam, 0 to 2 percent slopes (where drained) |
| WtA, WtB | Withee silt loam, 0 to 4 percent slopes |

Table 6.--Land Capability and Yields per Acre of Crops

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

| Soil name and map symbol | Land capability | Corn | Corn silage | Oats | Bromegrass-alfalfa hay | Timothy-red clover hay | Soybeans |
|---|---|---|---|---|---|---|---|
| | | Bu | Tons | Bu | Tons | Tons | Bu |
| AbB<br>Alban | IIe | 90 | 15 | 70 | 3.7 | --- | 30 |
| Ad<br>Altdorf | VIw | 75 | 12 | --- | --- | 3.5 | 25 |
| AmC<br>Amery | IIIe | 80 | 13 | 60 | 3.8 | --- | 26 |
| CbA<br>Cable | VIw | --- | --- | --- | --- | --- | --- |
| Ch<br>Cathro | VIw | --- | --- | --- | --- | --- | --- |
| CkA<br>Chetek | IIIs | 70 | 11 | 60 | 3.2 | --- | 23 |
| CkB<br>Chetek | IIIe | 70 | 11 | 60 | 3.2 | --- | 23 |
| CkC<br>Chetek | IVe | 65 | 10 | 55 | 3.0 | --- | 21 |
| CkE<br>Chetek | VIe | --- | --- | --- | 2.6 | --- | --- |
| Da<br>Dancy | VIw | 60 | 10 | --- | --- | 2.5 | --- |
| DoA<br>Dolph | IIw | 85 | 14 | 70 | 3.8 | 3.5 | 28 |
| DuB<br>Dunnville | IIIe | 75 | 12 | 55 | 3.8 | --- | 25 |
| FeC<br>Fenwood | IIIe | 95 | 15 | 70 | 4.0 | --- | 31 |
| FeD<br>Fenwood | IVe | 85 | 14 | 60 | 3.6 | --- | 28 |
| FfC<br>Fenwood | IVe | --- | --- | --- | --- | --- | --- |
| FfE<br>Fenwood | VIIe | --- | --- | --- | --- | --- | --- |
| FgB<br>Fenwood-Rozellville | IIe | 100 | 16 | 75 | 4.2 | --- | 33 |
| Fh<br>Fordum | VIw | --- | --- | --- | --- | --- | --- |
| FnB<br>Freeon | IIe | 90 | 15 | 75 | 4.3 | 4.0 | 30 |

Table 6.--Land Capability and Yields per Acre of Crops--Continued

| Soil name and map symbol | Land capability | Corn | Corn silage | Oats | Bromegrass-alfalfa hay | Timothy-red clover hay | Soybeans |
|---|---|---|---|---|---|---|---|
| | | Bu | Tons | Bu | Tons | Tons | Bu |
| FnC---------- Freeon | IIIe | 85 | 14 | 70 | 4.1 | 3.8 | 28 |
| GcB---------- Graycalm | IVs | 50 | 8 | 50 | 2.5 | 2.5 | 16 |
| Gm---------- Graycalm | IVs | 55 | 9 | 55 | 2.7 | 2.7 | 18 |
| Gr---------- Greenwood | VIIw | --- | --- | --- | --- | --- | --- |
| GuB---------- Guenther | IIIe | 60 | 10 | 50 | 3.0 | 2.5 | --- |
| HtB---------- Hatley | IIe | 80 | 13 | 65 | 4.0 | 3.3 | 26 |
| HyB---------- Hatley | IIIs | --- | --- | --- | --- | --- | --- |
| KaB---------- Kennan | IIe | 85 | 14 | 70 | 4.2 | --- | 28 |
| KaC---------- Kennan | IIIe | 80 | 13 | 65 | 4.0 | --- | 26 |
| KaD2---------- Kennan | VIe | 65 | 11 | 50 | 3.4 | --- | --- |
| KeB---------- Kennan | IIIs | --- | --- | --- | --- | --- | --- |
| KeC---------- Kennan | IVe | --- | --- | --- | --- | --- | --- |
| KeE---------- Kennan | VIIe | --- | --- | --- | --- | --- | --- |
| LDF. Landfill | | | | | | | |
| LoB---------- Loyal | IIe | 95 | 15 | 75 | 4.5 | 4.0 | 31 |
| LoC---------- Loyal | IIIe | 90 | 15 | 70 | 4.3 | 3.6 | 30 |
| MaB---------- Magnor | IIe | 85 | 14 | 70 | 3.8 | 3.5 | 28 |
| MbB---------- Mahtomedi | IVs | 40 | 7 | 40 | 2.5 | --- | 13 |
| MbC---------- Mahtomedi | VIs | 35 | 6 | 35 | 2.3 | --- | 12 |
| MbE---------- Mahtomedi | VIIs | --- | --- | --- | --- | --- | --- |
| McA---------- Mahtomedi | IVs | 45 | 8 | 24 | 2.8 | --- | 15 |

Table 6.--Land Capability and Yields per Acre of Crops--Continued

| Soil name and map symbol | Land capability | Corn | Corn silage | Oats | Bromegrass-alfalfa hay | Timothy-red clover hay | Soybeans |
|---|---|---|---|---|---|---|---|
| | | Bu | Tons | Bu | Tons | Tons | Bu |
| MdB---- Marathon | IIe | 85 | 14 | 75 | 4.0 | --- | 28 |
| MdC---- Marathon | IIIe | 80 | 13 | 70 | 3.8 | --- | 26 |
| MeC---- Marathon | IVe | --- | --- | --- | --- | --- | --- |
| MfA---- Marathon | IIIw* | 80 | 13 | 60 | --- | 3.0 | 26 |
| MgA---- Meadland | IIw | 80 | 13 | 65 | 3.5 | 3.5 | 26 |
| MhA---- Meadland | IIIs | --- | --- | --- | --- | --- | --- |
| Mm---- Meehan | IVw | 55 | 9 | 50 | 2.5 | 2.5 | 18 |
| Mn---- Minocqua | VIw | 70 | 12 | --- | --- | 3.0 | --- |
| MoB---- Moberg | IIIe | 55 | 9 | 50 | 2.5 | --- | 18 |
| MoC---- Moberg | IVe | 50 | 8 | 45 | 2.3 | --- | 16 |
| MsB---- Mosinee | IIIe | 65 | 10 | 60 | 3.5 | --- | 21 |
| MsC---- Mosinee | IVe | 60 | 10 | 55 | 3.3 | --- | 20 |
| MsD---- Mosinee | VIe | --- | --- | --- | --- | --- | --- |
| MtC---- Mosinee | VIe | --- | --- | --- | --- | --- | --- |
| MyB---- Mylrea | IIe | 80 | 13 | 70 | 3.8 | 3.0 | 26 |
| MzB---- Mylrea | IIIs | --- | --- | --- | --- | --- | --- |
| Ne---- Newson | VIw | --- | --- | --- | --- | --- | --- |
| Oe---- Oesterle | IIw | 80 | 13 | 70 | 4.0 | 2.9 | 25 |
| Pg, Ph. Pits | | | | | | | |
| Po---- Plover | IIw | 80 | 13 | 65 | 3.5 | 3.0 | 26 |

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Crops--Continued

| Soil name and map symbol | Land capability | Corn | Corn silage | Oats | Bromegrass-alfalfa hay | Timothy-red clover hay | Soybeans |
|---|---|---|---|---|---|---|---|
| | | Bu | Tons | Bu | Tons | Tons | Bu |
| RbC---Ribhill | VIs | --- | --- | --- | --- | --- | --- |
| RbE---Ribhill | VIIs | --- | --- | --- | --- | --- | --- |
| RcB---Rietbrock | IIe | 85 | 14 | 70 | 4.0 | 3.5 | 28 |
| ReB---Rietbrock | IIIs | --- | --- | --- | --- | --- | --- |
| RhA---Rockers | IIIw | 60 | 10 | 55 | 3.0 | 2.5 | --- |
| RoA---Rosholt | IIs | 70 | 12 | 55 | 3.4 | --- | 23 |
| RoB---Rosholt | IIe | 70 | 12 | 55 | 3.4 | --- | 23 |
| RsA---Rosholt | IIs | 80 | 13 | 70 | 3.7 | --- | 26 |
| RsB---Rosholt | IIe | 80 | 13 | 70 | 3.7 | --- | 26 |
| ScA---Scott Lake | IIs | 80 | 13 | 65 | 4.0 | --- | 27 |
| SdA---Scott Lake | IIs | 85 | 14 | 70 | 4.0 | --- | 28 |
| Se---Seelyeville | VIw | --- | --- | --- | --- | --- | --- |
| ShA---Sherry | IIIw* | 80 | 13 | 60 | --- | 3.0 | 26 |
| St---Sturgeon | IIIw | 70 | 11 | 65 | 3.1 | 2.5 | 23 |
| UoB, UoE. Udorthents | | | | | | | |
| WtA, WtB---Withee | IIw | 90 | 15 | 70 | --- | 4.0 | 30 |

* The land capability classification is VIw in undrained areas.

Table 7.--Woodland Management and Productivity

(Only the soils suitable for the production of commercial trees are listed. Absence of an entry indicates that information was not available)

| Soil name and map symbol | Ordination symbol | Management concerns | | | | Potential productivity | | | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| | | Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Common trees | Site index | Volume* | |
| AdB---Alban | 3L | Slight | Moderate | Slight | Slight | Sugar maple<br>American basswood<br>Yellow birch | 60<br>---<br--- | 38<br---<br--- | Red pine, eastern white pine, white spruce. |
| Ad---Altdorf | 3W | Slight | Severe | Severe | Severe | Red maple<br>Northern red oak<br>American elm<br>White ash | 70<br>70<br---<br--- | 43<br>66<br---<br--- | White spruce, red maple, white ash. |
| AmC---Amery | 4L | Slight | Moderate | Slight | Slight | Northern red oak<br>Quaking aspen<br>White oak<br>White ash<br>American basswood<br>Red maple<br>Sugar maple | 64<br---<br---<br---<br---<br---<br--- | 57<br---<br---<br---<br---<br---<br--- | Red pine, eastern white pine, white spruce, jack pine. |
| CbA---Cable | 2X | Slight | Severe | Severe | Severe | Red maple<br>Balsam fir<br>White ash<br>Black ash<br>Black spruce<br>Quaking aspen<br>White spruce | 56<br---<br---<br>48<br---<br---<br--- | 36<br---<br---<br>30<br---<br---<br--- | White spruce, red maple, balsam fir, black spruce. |
| Ch---Cathro | 7W | Slight | Severe | Severe | Severe | Balsam fir<br>Northern white-cedar<br>Tamarack<br>Paper birch<br>White spruce | 53<br>33<br---<br---<br--- | 102<br>48<br---<br---<br--- | --- |
| CkA, CkB, CkC---Chetek | 6A | Slight | Slight | Slight | Slight | Jack pine<br>Northern pin oak<br>Black oak<br>Eastern white pine | 57<br>53<br---<br--- | 80<br>36<br---<br--- | Red pine, jack pine, eastern white pine. |
| CkE---Chetek | 6R | Moderate | Moderate | Moderate | Slight | Jack pine<br>Northern pin oak<br>Black oak<br>Eastern white pine | 57<br>53<br---<br--- | 80<br>36<br---<br--- | Red pine, jack pine, eastern white pine. |
| Da---Dancy | 3W | Slight | Severe | Severe | Severe | Red maple<br>White ash<br>Balsam fir<br>White spruce | 60<br---<br---<br--- | 38<br---<br---<br--- | White spruce, eastern cottonwood, white ash, red maple. |
| DoA---Dolph | 2C | Slight | Severe | Moderate | Severe | Red maple<br>Northern red oak<br>Sugar maple<br>White ash | 55<br---<br---<br--- | 35<br---<br---<br--- | White spruce, eastern white pine. |

See footnote at end of table.

Table 7.--Woodland Management and Productivity--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| DuB---------- Dunnville | 3A | Slight | Slight | Slight | Slight | Northern red oak----<br>Sugar maple---------<br>American basswood--- | 55<br>---<br>--- | 42<br>---<br>--- | Eastern white pine, red pine, white spruce. |
| FeC---------- Fenwood | 3L | Slight | Moderate | Slight | Slight | Sugar maple---------<br>Northern red oak----<br>White ash-----------<br>American basswood---<br>Quaking aspen------- | 67<br>65<br>---<br>69<br>--- | 41<br>59<br>---<br>64<br>--- | Red pine, white spruce, eastern white pine. |
| FeD---------- Fenwood | 3R | Moderate | Moderate | Moderate | Slight | Sugar maple---------<br>Northern red oak----<br>White ash-----------<br>American basswood---<br>Quaking aspen------- | 67<br>65<br>---<br>69<br>--- | 41<br>59<br>---<br>64<br>--- | Red pine, white spruce, eastern white pine. |
| FfC---------- Fenwood | 3X | Slight | Moderate | Slight | Slight | Sugar maple---------<br>Northern red oak----<br>White ash-----------<br>American basswood--- | 67<br>65<br>---<br>69 | 41<br>59<br>---<br>64 | Eastern white pine, red pine, white spruce. |
| FfE---------- Fenwood | 3R | Slight | Moderate | Moderate | Slight | Sugar maple---------<br>Northern red oak----<br>White ash-----------<br>American basswood--- | 67<br>65<br>---<br>69 | 41<br>59<br>---<br>64 | Eastern white pine, red pine, white spruce. |
| FgB: | | | | | | | | | |
| Fenwood-------- | 3L | Slight | Moderate | Slight | Slight | Sugar maple---------<br>Northern red oak----<br>White ash-----------<br>American basswood---<br>Quaking aspen------- | 67<br>65<br>---<br>69<br>--- | 41<br>59<br>---<br>64<br>--- | Red pine, white spruce, eastern white pine. |
| Rozellville---- | 3L | Slight | Moderate | Slight | Slight | Sugar maple---------<br>American basswood---<br>Northern red oak---- | 60<br>---<br>--- | 38<br>---<br>--- | Red pine, eastern white pine, white spruce. |
| Fh---------- Fordum | 2W | Slight | Severe | Severe | Severe | Silver maple--------<br>Red maple-----------<br>White ash-----------<br>Northern white-cedar<br>Tamarack------------<br>Black spruce--------<br>Balsam fir----------<br>White spruce-------- | 80<br>---<br>---<br>---<br>---<br>---<br>---<br>--- | 34<br>---<br>---<br>---<br>---<br>---<br>---<br>--- | Silver maple, red maple, white ash. |
| FnB, FnC-------- Freeon | 3D | Slight | Moderate | Slight | Moderate | Sugar maple---------<br>Northern red oak----<br>American basswood---<br>Red maple-----------<br>White oak-----------<br>Quaking aspen-------<br>Bigtooth aspen------<br>White ash----------- | 62<br>63<br>---<br>---<br>---<br>---<br>---<br>--- | 39<br>56<br>---<br>---<br>---<br>---<br>---<br>--- | Red pine, eastern white pine, white spruce. |

See footnote at end of table.

Table 7.--Woodland Management and Productivity--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| GcB, Gm<br>Graycalm | 6S | Slight | Moderate | Moderate | Slight | Bigtooth aspen<br>Northern red oak<br>Jack pine<br>Red pine<br>Paper birch<br>Eastern white pine<br>American beech | 70<br>---<br>56<br>64<br>---<br>---<br>--- | 81<br>---<br>78<br>112<br>---<br>---<br>--- | Red pine, eastern white pine. |
| GuB<br>Guenther | 4A | Slight | Slight | Slight | Slight | Northern red oak<br>Red maple<br>Sugar maple<br>White ash | 68<br>65<br>---<br>--- | 63<br>40<br>---<br>--- | Red pine, eastern white pine, white spruce. |
| HtB<br>Hatley | 3W | Slight | Severe | Slight | Moderate | Red maple<br>Balsam fir<br>Bigtooth aspen<br>White ash<br>Quaking aspen<br>Paper birch<br>Yellow birch<br>Sugar maple | 66<br>57<br>---<br>---<br>---<br>---<br>---<br>--- | 41<br>111<br>---<br>---<br>---<br>---<br>---<br>--- | Red pine, eastern white pine, white spruce. |
| HyB<br>Hatley | 3X | Slight | Severe | Slight | Moderate | Red maple<br>Balsam fir<br>Bigtooth aspen<br>White ash<br>Quaking aspen<br>Paper birch<br>Yellow birch<br>Sugar maple | 66<br>57<br>---<br>---<br>---<br>---<br>---<br>--- | 41<br>111<br>---<br>---<br>---<br>---<br>---<br>--- | Red pine, eastern white pine, white spruce. |
| KaB, KaC<br>Kennan | 3L | Slight | Moderate | Slight | Slight | Sugar maple<br>Northern red oak<br>American basswood<br>White ash<br>Bigtooth aspen<br>Quaking aspen<br>Yellow birch | 68<br>76<br>72<br>77<br>---<br>---<br>--- | 42<br>75<br>69<br>76<br>---<br>---<br>--- | Red pine, white spruce, eastern white pine. |
| KaD2<br>Kennan | 3R | Moderate | Moderate | Moderate | Slight | Sugar maple<br>Northern red oak<br>American basswood<br>White ash<br>Bigtooth aspen<br>Quaking aspen<br>Yellow birch | 68<br>76<br>72<br>77<br>---<br>---<br>--- | 42<br>75<br>69<br>76<br>---<br>---<br>--- | Red pine, white spruce, eastern white pine. |
| KeB, KeC<br>Kennan | 3X | Slight | Moderate | Slight | Slight | Sugar maple<br>Northern red oak<br>American basswood<br>White ash<br>Bigtooth aspen<br>Quaking aspen<br>Yellow birch | 68<br>76<br>72<br>77<br>---<br>---<br>--- | 42<br>75<br>69<br>76<br>---<br>---<br>--- | Red pine, eastern white pine, white spruce. |

See footnote at end of table.

Table 7.--Woodland Management and Productivity--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| KeE---------- Kennan | 3R | Slight | Moderate | Moderate | Slight | Sugar maple---------<br>Northern red oak----<br>American basswood---<br>White ash----------<br>Bigtooth aspen------<br>Quaking aspen-------<br>Yellow birch-------- | 68<br>76<br>72<br>77<br>---<br>---<br>--- | 42<br>75<br>69<br>76<br>---<br>---<br>--- | Red pine,<br>eastern white<br>pine, white<br>spruce. |
| LoB, LoC-------- Loyal | 3D | Slight | Moderate | Slight | Moderate | Sugar maple---------<br>White ash----------<br>Northern red oak----<br>American basswood--- | 60<br>---<br>---<br>--- | 38<br>---<br>---<br>--- | White spruce,<br>red pine,<br>eastern white<br>pine. |
| MaB---------- Magnor | 3W | Slight | Severe | Moderate | Severe | Sugar maple---------<br>Northern red oak----<br>Red maple----------<br>American basswood---<br>Yellow birch--------<br>White ash----------<br>Quaking aspen-------<br>Bigtooth aspen------ | 61<br>67<br>65<br>67<br>---<br>68<br>---<br>--- | 38<br>61<br>40<br>61<br>---<br>63<br>---<br>--- | Eastern white<br>pine, white<br>spruce, red<br>pine. |
| MbB, MbC-------- Mahtomedi | 6S | Slight | Moderate | Moderate | Slight | Red pine----------<br>White spruce--------<br>Jack pine----------<br>Eastern white pine--<br>Bigtooth aspen------<br>Northern red oak---- | 55<br>---<br>60<br>59<br>77<br>48 | 88<br>---<br>85<br>118<br>90<br>31 | Red pine, jack<br>pine, eastern<br>white pine,<br>white spruce. |
| MbE---------- Mahtomedi | 6R | Moderate | Moderate | Moderate | Slight | Red pine----------<br>White spruce--------<br>Jack pine----------<br>Eastern white pine--<br>Bigtooth aspen------<br>Northern red oak---- | 55<br>---<br>60<br>59<br>77<br>48 | 88<br>---<br>85<br>118<br>90<br>31 | Red pine, jack<br>pine, eastern<br>white pine,<br>white spruce. |
| McA---------- Mahtomedi | 6S | Slight | Moderate | Slight | Slight | Red pine----------<br>Jack pine----------<br>Eastern white pine--<br>Northern pin oak---- | 55<br>60<br>---<br>--- | 88<br>85<br>---<br>--- | Red pine,<br>eastern white<br>pine, jack<br>pine, white<br>spruce. |
| MdB, MdC-------- Marathon | 3L | Slight | Moderate | Slight | Slight | Sugar maple---------<br>Northern red oak----<br>American basswood--- | 61<br>65<br>--- | 38<br>59<br>--- | Eastern white<br>pine, red<br>pine, white<br>spruce. |
| MeC---------- Marathon | 3X | Slight | Moderate | Slight | Slight | Sugar maple---------<br>Northern red oak----<br>American basswood--- | 61<br>65<br>--- | 38<br>59<br>--- | Eastern white<br>pine, red<br>pine, white<br>spruce. |
| MfA---------- Marshfield | 3W | Slight | Severe | Severe | Severe | White ash----------<br>Red maple----------<br>Balsam fir----------<br>White spruce-------- | 54<br>---<br>---<br>--- | 40<br>---<br>---<br>--- | White spruce,<br>red maple,<br>white ash. |

See footnote at end of table.

Table 7.--Woodland Management and Productivity--Continued

| Soil name and map symbol | Ordination symbol | Management concerns | | | | Potential productivity | | | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| | | Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Common trees | Site index | Volume* | |
| MgA---------- Meadland | 5W | Slight | Severe | Slight | Moderate | Northern red oak---- | 73 | 70 | White spruce, eastern white pine, red maple, white ash. |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Red maple---------- | 73 | 45 | |
| | | | | | | White ash---------- | --- | --- | |
| | | | | | | American basswood--- | --- | --- | |
| MhA---------- Meadland | 5X | Slight | Severe | Slight | Moderate | Northern red oak---- | 73 | 70 | White spruce, eastern white pine, red maple, white ash. |
| | | | | | | Sugar maple--------- | --- | --- | |
| | | | | | | Red maple---------- | 73 | 45 | |
| | | | | | | White ash---------- | --- | --- | |
| | | | | | | American basswood--- | --- | --- | |
| Mm---------- Meehan | 5W | Slight | Moderate | Slight | Moderate | Jack pine---------- | 55 | 77 | Eastern white pine, jack pine, white spruce, balsam fir, red pine, red maple. |
| | | | | | | Eastern white pine-- | 62 | 127 | |
| | | | | | | Northern pin oak---- | 60 | 43 | |
| | | | | | | Red pine----------- | 50 | 75 | |
| | | | | | | Paper birch-------- | --- | --- | |
| | | | | | | Quaking aspen------- | --- | --- | |
| | | | | | | Balsam fir---------- | --- | --- | |
| | | | | | | White spruce-------- | --- | --- | |
| | | | | | | Black spruce-------- | --- | --- | |
| Mn---------- Minocqua | 7W | Slight | Severe | Severe | Severe | Balsam fir---------- | 54 | 105 | Red maple, white ash, white spruce, black spruce. |
| | | | | | | Red maple---------- | 55 | 35 | |
| | | | | | | White ash---------- | --- | --- | |
| | | | | | | Black ash---------- | --- | --- | |
| | | | | | | Tamarack----------- | 55 | 50 | |
| | | | | | | Northern white-cedar | --- | --- | |
| | | | | | | Quaking aspen------- | --- | --- | |
| MoB, MoC-------- Moberg | 3F | Slight | Slight | Moderate | Slight | Northern red oak---- | 54 | 40 | Red pine, jack pine, eastern white pine. |
| | | | | | | Jack pine---------- | 55 | 77 | |
| | | | | | | Northern pin oak---- | --- | --- | |
| | | | | | | Black oak---------- | --- | --- | |
| | | | | | | Red pine----------- | --- | --- | |
| MsB, MsC-------- Mosinee | 4F | Slight | Moderate | Slight | Slight | Northern red oak---- | 65 | 59 | Red pine, eastern white pine, jack pine, Norway spruce. |
| | | | | | | Red maple---------- | --- | --- | |
| | | | | | | Eastern white pine-- | --- | --- | |
| MsD---------- Mosinee | 4R | Moderate | Moderate | Moderate | Slight | Northern red oak---- | 65 | 59 | Red pine, eastern white pine, jack pine, Norway spruce. |
| | | | | | | Red maple---------- | --- | --- | |
| | | | | | | Eastern white pine-- | --- | --- | |
| MtC---------- Mosinee | 4X | Slight | Moderate | Slight | Slight | Northern red oak---- | 65 | 59 | Red pine, eastern white pine, jack pine, Norway spruce. |
| | | | | | | Red maple---------- | --- | --- | |
| | | | | | | Eastern white pine-- | --- | --- | |

See footnote at end of table.

Table 7.--Woodland Management and Productivity--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| MyB---------- Mylrea | 3W | Slight | Severe | Slight | Moderate | Sugar maple---------<br>Red maple----------<br>American basswood---<br>Northern red oak----<br>Yellow birch--------<br>White ash----------<br>Quaking aspen------- | 63<br>71<br>---<br>69<br>---<br>---<br>--- | 39<br>44<br>---<br>64<br>---<br>---<br>--- | Red pine, eastern white pine, white spruce, black spruce. |
| MzB---------- Mylrea | 3X | Slight | Severe | Slight | Moderate | Sugar maple---------<br>Red maple----------<br>American basswood---<br>Northern red oak----<br>Yellow birch--------<br>White ash---------- | 63<br>71<br>---<br>69<br>---<br>--- | 39<br>45<br>---<br>64<br>---<br>--- | Red pine, eastern white pine, white spruce, black spruce. |
| Ne---------- Newson | 6W | Slight | Severe | Severe | Severe | Jack pine----------<br>Quaking aspen-------<br>Paper birch---------<br>Eastern white pine-- | 59<br>50<br>---<br>--- | 84<br>43<br>---<br>--- | Eastern white pine, white spruce. |
| Oe---------- Oesterle | 3W | Slight | Severe | Slight | Moderate | Red maple----------<br>Northern red oak----<br>Quaking aspen-------<br>Balsam fir----------<br>Paper birch---------<br>Yellow birch-------- | 66<br>72<br>78<br>---<br>---<br>--- | 41<br>69<br>91<br>---<br>---<br>--- | Red maple, white ash, white spruce. |
| Po---------- Plover | 3W | Slight | Severe | Slight | Moderate | Red maple----------<br>American basswood---<br>American elm--------<br>Yellow birch-------- | 65<br>---<br>---<br>--- | 40<br>---<br>---<br>--- | Eastern white pine, white spruce, black spruce. |
| RbC---------- Ribhill | 4X | Slight | Moderate | Slight | Slight | Northern red oak----<br>Sugar maple---------<br>White ash----------<br>American basswood--- | 66<br>60<br>---<br>--- | 60<br>38<br>---<br>--- | Red pine, eastern white pine, white spruce. |
| RbE---------- Ribhill | 4R | Slight | Moderate | Moderate | Slight | Northern red oak----<br>Sugar maple---------<br>White ash----------<br>American basswood--- | 66<br>60<br>---<br>--- | 60<br>38<br>---<br>--- | Red pine, eastern white pine, white spruce. |
| RcB---------- Rietbrock | 3W | Slight | Severe | Slight | Moderate | Red maple----------<br>American basswood---<br>Quaking aspen-------<br>White ash----------<br>Northern red oak----<br>Sugar maple--------- | 65<br>---<br>---<br>---<br>70<br>55 | 40<br>---<br>---<br>---<br>66<br>35 | Eastern white pine, white spruce, black spruce, red maple. |
| ReB---------- Rietbrock | 3X | Slight | Severe | Slight | Moderate | Red maple----------<br>American basswood---<br>Quaking aspen-------<br>White ash----------<br>Northern red oak----<br>Sugar maple--------- | 65<br>---<br>---<br>---<br>70<br>55 | 40<br>---<br>---<br>---<br>66<br>35 | Eastern white pine, white spruce, black spruce, red maple. |

See footnote at end of table.

Table 7.--Woodland Management and Productivity--Continued

| Soil name and map symbol | Ordination symbol | Management concerns: Erosion hazard | Equipment limitation | Seedling mortality | Windthrow hazard | Potential productivity: Common trees | Site index | Volume* | Trees to plant |
|---|---|---|---|---|---|---|---|---|---|
| RhA---------- Rockers | 3W | Slight | Severe | Slight | Moderate | Northern pin oak---- | 55 | 38 | Eastern white pine, red pine, jack pine. |
| | | | | | | Jack pine---------- | --- | --- | |
| | | | | | | Red pine---------- | --- | --- | |
| | | | | | | Eastern white pine-- | --- | --- | |
| RoA, RoB, RsA, RsB---------- Rosholt | 3L | Slight | Slight | Slight | Slight | Sugar maple--------- | 65 | 40 | Red pine, eastern white pine. |
| | | | | | | White ash---------- | 77 | 76 | |
| | | | | | | American basswood--- | --- | --- | |
| | | | | | | Northern red oak---- | 69 | 64 | |
| ScA, SdA-------- Scott Lake | 3L | Slight | Moderate | Slight | Slight | Sugar maple--------- | 61 | 38 | Eastern white pine, red pine, white spruce, black spruce. |
| | | | | | | Northern red oak---- | 65 | 59 | |
| | | | | | | Yellow birch-------- | --- | --- | |
| | | | | | | American basswood--- | --- | --- | |
| | | | | | | Red maple---------- | --- | --- | |
| | | | | | | Quaking aspen------- | --- | --- | |
| | | | | | | Bigtooth aspen------ | --- | --- | |
| | | | | | | White ash---------- | --- | --- | |
| Se---------- Seelyeville | 8W | Slight | Severe | Severe | Severe | Balsam fir---------- | 56 | 109 | Black spruce, tamarack, balsam fir, northern white-cedar. |
| | | | | | | Black spruce-------- | 34 | 45 | |
| | | | | | | Tamarack----------- | 56 | 52 | |
| | | | | | | Black ash---------- | 55 | 35 | |
| | | | | | | Northern white-cedar | 30 | 42 | |
| ShA---------- Sherry | 3W | Slight | Severe | Severe | Severe | Red maple---------- | 61 | 38 | White spruce, black spruce, red maple, white ash. |
| | | | | | | Black ash---------- | 53 | 34 | |
| | | | | | | White ash---------- | 66 | 60 | |
| | | | | | | Quaking aspen------- | --- | --- | |
| | | | | | | Yellow birch-------- | --- | --- | |
| | | | | | | White spruce-------- | --- | --- | |
| | | | | | | Black spruce-------- | --- | --- | |
| | | | | | | Paper birch--------- | --- | --- | |
| | | | | | | Northern red oak---- | 61 | 53 | |
| St---------- Sturgeon | 2W | Slight | Severe | Moderate | Severe | Silver maple-------- | 80 | 34 | White spruce, Norway spruce. |
| | | | | | | Red maple---------- | 65 | 40 | |
| | | | | | | American basswood--- | --- | --- | |
| | | | | | | Yellow birch-------- | --- | --- | |
| | | | | | | Quaking aspen------- | --- | --- | |
| | | | | | | Balsam fir---------- | --- | --- | |
| | | | | | | Eastern hemlock----- | --- | --- | |
| | | | | | | White spruce-------- | --- | --- | |
| | | | | | | Northern white-cedar | --- | --- | |
| | | | | | | American elm-------- | --- | --- | |
| | | | | | | Sugar maple--------- | --- | --- | |
| WtA, WtB-------- Withee | 4W | Slight | Severe | Moderate | Moderate | Northern red oak---- | 69 | 64 | White spruce, eastern white pine, white spruce, red pine, white ash, red maple. |
| | | | | | | Sugar maple--------- | 64 | 40 | |
| | | | | | | American basswood--- | --- | --- | |
| | | | | | | Yellow birch-------- | --- | --- | |
| | | | | | | White ash---------- | 69 | 64 | |
| | | | | | | Red maple---------- | --- | --- | |

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

**Table 8.--Windbreaks and Environmental Plantings**

**(Only the soils suitable for windbreaks and environmental plantings are listed. The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)**

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| AbB---- Alban | --- | Northern white-cedar, lilac, American cranberrybush, Amur maple, gray dogwood. | White spruce, Norway spruce, Black Hills spruce. | Eastern white pine, red maple, red pine, white ash. | --- |
| AmC---- Amery | --- | Lilac, American cranberrybush, Amur maple, northern white-cedar, gray dogwood. | White spruce, Norway spruce, Black Hills spruce. | Eastern white pine, red pine, white ash, red maple. | --- |
| CkA, CkB, CkC, CkE---- Chetek | Manyflower cotoneaster. | Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, gray dogwood, silky dogwood. | Norway spruce----- | Eastern white pine, red pine, jack pine. | --- |
| DoA---- Dolph | --- | Northern white-cedar, lilac, alternateleaf dogwood, American cranberrybush, silky dogwood, gray dogwood. | White spruce------ | Red maple, eastern white pine, red pine, white ash, green ash. | --- |
| DuB---- Dunnville | Manyflower cotoneaster. | Siberian peashrub, eastern redcedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood. | Norway spruce----- | Eastern white pine, red pine, jack pine. | --- |
| FeC, FeD---- Fenwood | --- | Northern white-cedar, lilac, Amur maple, American cranberrybush, gray dogwood. | White spruce, Black Hills spruce, Norway spruce. | Eastern white pine, red pine, red maple, white ash. | --- |
| FgB: Fenwood---- | --- | Northern white-cedar, lilac, Amur maple, American cranberrybush, gray dogwood. | White spruce, Black Hills spruce, Norway spruce. | Eastern white pine, red pine, red maple, white ash. | --- |

Table 8.--Windbreaks and Environmental Plantings--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| FgB: Rozellville | --- | Northern white-cedar, lilac, American cranberrybush, Amur maple, gray dogwood. | White spruce, Norway spruce, Black Hills spruce. | Eastern white pine, red pine, white ash, red maple. | --- |
| FnB, FnC: Freeon | --- | Amur maple, lilac, American cranberrybush, northern white-cedar, gray dogwood. | White spruce, Norway spruce, Black Hills spruce. | Eastern white pine, red pine, white ash, red maple. | --- |
| GcB: Graycalm | Vanhoutte spirea, manyflower cotoneaster. | Siberian peashrub, lilac, Amur privet, Amur maple. | Eastern redcedar, Siberian crabapple. | Red pine, jack pine, eastern white pine. | Imperial Carolina poplar. |
| Gm: Graycalm | Manyflower cotoneaster. | Nannyberry viburnum, eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood. | --- | Eastern white pine, jack pine, Norway spruce. | --- |
| GuB: Guenther | Manyflower cotoneaster. | Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood. | Norway spruce | Eastern white pine, red pine, jack pine. | --- |
| HtB: Hatley | --- | Northern white-cedar, lilac, American cranberrybush, silky dogwood, nannyberry viburnum, redosier dogwood. | White spruce | Eastern white pine, red pine, white ash, red maple, silver maple. | --- |
| KaB, KaC, KaD2: Kennan | Manyflower cotoneaster. | Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood. | Norway spruce | Eastern white pine, red pine, jack pine. | --- |

Table 8.--Windbreaks and Environmental Plantings--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| LoB, LoC----------<br>Loyal | --- | American cranberrybush, Amur maple, lilac, northern white-cedar, gray dogwood. | Black Hills spruce, Norway spruce, white spruce. | Eastern white pine, red maple, red pine, white ash. | --- |
| MaB----------<br>Magnor | --- | Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood. | White spruce------ | Eastern white pine, red pine, white ash, red maple, silver maple. | --- |
| MbB, MbC, MbE-----<br>Mahtomedi | Manyflower cotoneaster. | Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, eastern redcedar. | Norway spruce----- | Jack pine, red pine, eastern white pine. | --- |
| McA----------<br>Mahtomedi | Manyflower cotoneaster. | Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood. | Norway spruce----- | Eastern white pine, red pine, jack pine. | --- |
| MdB, MdC----------<br>Marathon | Manyflower cotoneaster. | Siberian peashrub, lilac, Amur maple, American cranberrybush, silky dogwood, gray dogwood, eastern redcedar. | Norway spruce----- | Eastern white pine, red pine, jack pine. | --- |
| MfA----------<br>Marshfield | --- | Northern white-cedar, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark. | White spruce, balsam fir. | Silver maple, white ash, green ash, red maple. | --- |
| MgA----------<br>Meadland | --- | Nannyberry viburnum, northern white-cedar, lilac, American cranberrybush, silky dogwood, redosier dogwood. | White spruce------ | Eastern white pine, red pine, white ash, red maple, silver maple. | --- |

Table 8.--Windbreaks and Environmental Plantings--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| Mm---------- Meehan | --- | Redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, lilac, northern white-cedar. | White spruce------ | Red maple, white ash, silver maple, red pine, eastern white pine. | --- |
| MoB, MoC---------- Moberg | Manyflower cotoneaster. | Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood. | Norway spruce----- | Eastern white pine, red pine, jack pine. | --- |
| MsB, MsC, MsD----- Mosinee | Manyflower cotoneaster. | Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood. | Norway spruce----- | Eastern white pine, red pine, jack pine. | --- |
| MyB---------- Mylrea | --- | Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood. | White spruce------ | Eastern white pine, red pine, white ash, red maple, silver maple. | --- |
| Oe---------- Oesterle | --- | Nannyberry viburnum, American cranberrybush, redosier dogwood, lilac, northern white-cedar, silky dogwood. | White spruce------ | Red maple, silver maple, white ash, red pine, eastern white pine. | --- |
| Po---------- Plover | --- | Northern white-cedar, nannyberry viburnum, silky dogwood, American cranberrybush, redosier dogwood, lilac. | White spruce------ | Eastern white pine, red maple, white ash, red pine, silver maple. | --- |
| RcB---------- Rietbrock | --- | Northern white-cedar, nannyberry viburnum, redosier dogwood, American cranberrybush, lilac, silky dogwood, gray dogwood. | White spruce------ | Silver maple, eastern white pine, red maple, white ash. | --- |

Table 8.--Windbreaks and Environmental Plantings--Continued

| Soil name and map symbol | Trees having predicted 20-year average height, in feet, of-- | | | | |
|---|---|---|---|---|---|
| | <8 | 8-15 | 16-25 | 26-35 | >35 |
| RhA---------- Rockers | --- | Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood. | White spruce------ | Eastern white pine, red pine, red maple, silver maple, white ash. | --- |
| RoA, RoB, RsA, RsB---------- Rosholt | Manyflower cotoneaster. | Lilac, American cranberrybush, Amur maple, eastern redcedar, Siberian peashrub, gray dogwood, silky dogwood. | Norway spruce----- | Red pine, jack pine, eastern white pine. | --- |
| ScA, SdA---------- Scott Lake | Manyflower cotoneaster. | American cranberrybush, eastern redcedar, Siberian peashrub, lilac, gray dogwood, Amur maple. | Norway spruce----- | Eastern white pine, red pine, jack pine. | --- |
| Se---------- Seelyeville | Common ninebark--- | --- | --- | Golden willow, white willow. | Imperial Carolina poplar. |
| St---------- Sturgeon | --- | Silky dogwood, nannyberry viburnum, American cranberrybush, Amur privet. | White spruce, northern white-cedar, Manchurian crabapple. | Eastern white pine, Norway spruce, green ash, red maple. | Imperial Carolina poplar. |
| WtA, WtB---------- Withee | --- | Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood. | White spruce, silver maple. | Eastern white pine, red pine, white ash, red | --- |

Table 9.--Recreational Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| AbB<br>Alban | Slight | Slight | Moderate:<br>slope. | Slight | Slight. |
| Ad<br>Altdorf | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. |
| AmC<br>Amery | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Slight | Moderate:<br>slope. |
| CbA<br>Cable | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>large stones,<br>ponding. |
| Ch<br>Cathro | Severe:<br>ponding,<br>excess humus. | Severe:<br>ponding,<br>excess humus. | Severe:<br>excess humus,<br>ponding. | Severe:<br>ponding,<br>excess humus. | Severe:<br>ponding,<br>excess humus. |
| CkA<br>Chetek | Slight | Slight | Moderate:<br>small stones. | Slight | Moderate:<br>large stones,<br>droughty. |
| CkB<br>Chetek | Slight | Slight | Moderate:<br>slope,<br>small stones. | Slight | Moderate:<br>large stones,<br>droughty. |
| CkC<br>Chetek | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Slight | Moderate:<br>large stones,<br>droughty,<br>slope. |
| CkE<br>Chetek | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. |
| Da<br>Dancy | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. |
| DoA<br>Dolph | Severe:<br>wetness. | Moderate:<br>wetness. | Severe:<br>wetness. | Moderate:<br>wetness. | Moderate:<br>wetness. |
| DuB<br>Dunnville | Severe:<br>flooding. | Slight | Moderate:<br>slope. | Slight | Moderate:<br>droughty. |
| FeC<br>Fenwood | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Severe:<br>erodes easily. | Moderate:<br>large stones,<br>slope. |
| FeD<br>Fenwood | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>erodes easily. | Severe:<br>slope. |
| FfC<br>Fenwood | Moderate:<br>slope,<br>large stones. | Moderate:<br>slope,<br>large stones. | Severe:<br>large stones,<br>slope. | Moderate:<br>large stones. | Severe:<br>large stones. |
| FfE<br>Fenwood | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>large stones,<br>slope. | Moderate:<br>large stones,<br>slope. | Severe:<br>large stones,<br>slope. |

Table 9.--Recreational Development--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| FgB: | | | | | |
| Fenwood | Slight | Slight | Moderate: slope, small stones. | Slight | Moderate: large stones. |
| Rozellville | Slight | Slight | Moderate: slope, small stones. | Slight | Slight. |
| Fh | Severe: flooding, ponding. | Severe: ponding. | Severe: ponding, flooding. | Severe: ponding. | Severe: ponding, flooding. |
| FnB | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Moderate: slope, wetness, percs slowly. | Slight | Slight. |
| FnC | Moderate: slope, wetness, percs slowly. | Moderate: slope, wetness, percs slowly. | Severe: slope. | Severe: erodes easily. | Moderate: slope. |
| GcB | Moderate: too sandy. | Moderate: too sandy. | Moderate: slope, small stones, too sandy. | Moderate: too sandy. | Severe: droughty. |
| Gm | Moderate: too sandy. | Moderate: too sandy. | Moderate: small stones, too sandy. | Moderate: too sandy. | Severe: droughty. |
| Gr | Severe: ponding, excess humus. | Severe: ponding, excess humus. | Severe: excess humus, ponding. | Severe: ponding, excess humus. | Severe: ponding, excess humus. |
| GuB | Moderate: too sandy. | Moderate: too sandy. | Moderate: slope, too sandy. | Moderate: too sandy. | Moderate: droughty. |
| HtB | Severe: wetness. | Moderate: wetness, small stones. | Severe: small stones, wetness. | Moderate: wetness. | Moderate: small stones, large stones, wetness. |
| HyB | Severe: wetness. | Moderate: wetness, small stones. | Severe: large stones, small stones, wetness. | Moderate: large stones, wetness. | Severe: large stones. |
| KaB | Slight | Slight | Moderate: small stones, slope. | Slight | Moderate: large stones. |
| KaC | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight | Moderate: large stones, slope. |
| KaD2 | Severe: slope. | Severe: slope. | Severe: slope. | Moderate: slope. | Severe: slope. |

Table 9.--Recreational Development--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| KeB<br>Kennan | Moderate:<br>large stones. | Moderate:<br>large stones. | Severe:<br>large stones. | Moderate:<br>large stones. | Severe:<br>large stones. |
| KeC<br>Kennan | Moderate:<br>slope,<br>large stones. | Moderate:<br>slope,<br>large stones. | Severe:<br>large stones,<br>slope. | Moderate:<br>large stones. | Severe:<br>large stones. |
| KeE<br>Kennan | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>large stones,<br>slope. | Moderate:<br>large stones,<br>slope. | Severe:<br>large stones,<br>slope. |
| LDF.<br>Landfill | | | | | |
| LoB<br>Loyal | Moderate:<br>wetness,<br>percs slowly. | Moderate:<br>wetness,<br>percs slowly. | Moderate:<br>slope,<br>wetness,<br>percs slowly. | Slight | Slight. |
| LoC<br>Loyal | Moderate:<br>slope,<br>wetness,<br>percs slowly. | Moderate:<br>slope,<br>wetness,<br>percs slowly. | Severe:<br>slope. | Severe:<br>erodes easily. | Moderate:<br>slope. |
| MaB<br>Magnor | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. |
| MbB<br>Mahtomedi | Moderate:<br>small stones,<br>too sandy. | Moderate:<br>small stones,<br>too sandy. | Severe:<br>small stones. | Moderate:<br>too sandy. | Moderate:<br>small stones,<br>droughty. |
| MbC<br>Mahtomedi | Moderate:<br>slope,<br>small stones,<br>too sandy. | Moderate:<br>slope,<br>small stones,<br>too sandy. | Severe:<br>slope,<br>small stones. | Moderate:<br>too sandy. | Moderate:<br>small stones,<br>droughty. |
| MbE<br>Mahtomedi | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope,<br>small stones. | Severe:<br>slope. | Severe:<br>slope. |
| McA<br>Mahtomedi | Moderate:<br>small stones,<br>too sandy. | Moderate:<br>small stones,<br>too sandy. | Severe:<br>small stones. | Moderate:<br>too sandy. | Moderate:<br>small stones,<br>droughty. |
| MdB<br>Marathon | Slight | Slight | Moderate:<br>slope,<br>small stones. | Slight | Slight. |
| MdC<br>Marathon | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Severe:<br>erodes easily. | Moderate:<br>slope. |
| MeC<br>Marathon | Moderate:<br>slope,<br>large stones. | Moderate:<br>slope,<br>large stones. | Severe:<br>large stones,<br>slope. | Moderate:<br>large stones. | Severe:<br>large stones. |
| MfA<br>Marshfield | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. |
| MgA<br>Meadland | Severe:<br>wetness. | Moderate:<br>wetness. | Severe:<br>wetness. | Moderate:<br>wetness. | Moderate:<br>large stones,<br>wetness. |

Table 9.--Recreational Development--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| MhA---------- Meadland | Severe: wetness. | Moderate: wetness, large stones. | Severe: large stones, wetness. | Moderate: large stones, wetness. | Severe: large stones. |
| Mm---------- Meehan | Severe: wetness. | Moderate: wetness, too sandy. | Severe: wetness. | Moderate: wetness, too sandy. | Moderate: wetness, droughty. |
| Mn---------- Minocqua | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |
| MoB---------- Moberg | Moderate: small stones. | Moderate: small stones. | Severe: small stones. | Slight---------- | Severe: droughty. |
| MoC---------- Moberg | Moderate: slope, small stones. | Moderate: slope, small stones. | Severe: slope, small stones. | Slight---------- | Severe: droughty. |
| MsB---------- Mosinee | Slight---------- | Slight---------- | Moderate: slope, small stones. | Slight---------- | Moderate: large stones, droughty. |
| MsC---------- Mosinee | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight---------- | Moderate: large stones, droughty, slope. |
| MsD---------- Mosinee | Severe: slope. | Severe: slope. | Severe: slope. | Moderate: slope. | Severe: slope. |
| MtC---------- Mosinee | Moderate: slope, large stones. | Moderate: slope, large stones. | Severe: large stones, slope. | Moderate: large stones. | Severe: large stones, droughty. |
| MyB---------- Mylrea | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Moderate: wetness. |
| MzB---------- Mylrea | Severe: wetness. | Moderate: wetness, large stones. | Severe: large stones, wetness. | Moderate: large stones, wetness. | Severe: large stones. |
| Ne---------- Newson | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |
| Oe---------- Oesterle | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Moderate: large stones, wetness, droughty. |
| Pg, Ph. Pits | | | | | |
| Po---------- Plover | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness. | Moderate: wetness. |
| RbC---------- Ribhill | Moderate: slope, large stones. | Moderate: slope, large stones. | Severe: large stones, slope. | Moderate: large stones. | Severe: large stones. |

Table 9.--Recreational Development--Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|---|---|---|---|---|---|
| RbE<br>Ribhill | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>large stones,<br>slope. | Moderate:<br>large stones,<br>slope. | Severe:<br>large stones,<br>slope. |
| RcB<br>Rietbrock | Severe:<br>wetness. | Moderate:<br>wetness. | Severe:<br>wetness. | Moderate:<br>wetness. | Moderate:<br>large stones,<br>wetness,<br>droughty. |
| ReB<br>Rietbrock | Severe:<br>wetness. | Moderate:<br>wetness,<br>large stones. | Severe:<br>large stones,<br>wetness. | Moderate:<br>large stones,<br>wetness. | Severe:<br>large stones. |
| RhA<br>Rockers | Severe:<br>wetness. | Moderate:<br>wetness,<br>percs slowly. | Severe:<br>wetness. | Moderate:<br>wetness. | Moderate:<br>wetness. |
| RoA, RoB, RsA, RsB<br>Rosholt | Moderate:<br>small stones. | Moderate:<br>small stones. | Severe:<br>small stones. | Slight | Moderate:<br>small stones,<br>droughty. |
| ScA, SdA<br>Scott Lake | Slight | Slight | Moderate:<br>small stones. | Slight | Moderate:<br>large stones,<br>droughty. |
| Se<br>Seelyeville | Severe:<br>ponding,<br>excess humus. | Severe:<br>ponding,<br>excess humus. | Severe:<br>excess humus,<br>ponding. | Severe:<br>ponding,<br>excess humus. | Severe:<br>ponding,<br>excess humus. |
| ShA<br>Sherry | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. |
| St<br>Sturgeon | Severe:<br>flooding,<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. |
| UoB, UoE.<br>Udorthents | | | | | |
| WtA, WtB<br>Withee | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. |

**Table 10.--Wildlife Habitat**

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| AdB---- Alban | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| Ad---- Altdorf | Poor | Poor | Fair | Fair | Fair | Good | Good | Poor | Fair | Good. |
| AmC---- Amery | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| CbA---- Cable | Very poor. | Very poor. | Poor | Fair | Fair | Good | Good | Very poor. | Poor | Good. |
| Ch---- Cathro | Poor | Poor | Poor | Poor | Poor | Good | Good | Poor | Poor | Good. |
| CkA, CkB, CkC---- Chetek | Fair | Fair | Fair | Fair | Fair | Very poor. | Very poor. | Fair | Fair | Very poor. |
| CkE---- Chetek | Poor | Fair | Fair | Fair | Fair | Very poor. | Very poor. | Fair | Fair | Very poor. |
| Da---- Dancy | Poor | Poor | Fair | Fair | Fair | Good | Good | Poor | Fair | Good. |
| DoA---- Dolph | Good | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| DuB---- Dunnville | Fair | Fair | Good | Good | Good | Poor | Poor | Fair | Fair | Poor. |
| FeC---- Fenwood | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| FeD---- Fenwood | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| FfC, FfE---- Fenwood | Very poor. | Poor | Good | Good | Good | Very poor. | Very poor. | Poor | Good | Very poor. |
| FgB: | | | | | | | | | | |
| Fenwood---- | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| Rozellville---- | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| Fh---- Fordum | Very poor. | Very poor. | Poor | Fair | Fair | Good | Good | Very poor. | Fair | Good. |
| FnB---- Freeon | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| FnC---- Freeon | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |

Table 10.--Wildlife Habitat--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herba-ceous plants | Hardwood trees | Conif-erous plants | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| GcB, Gm---- Graycalm | Poor | Poor | Fair | Good | Good | Very poor. | Very poor. | Poor | Good | Very poor. |
| Gr---- Greenwood | Very poor. | Poor | Poor | Poor | Poor | Good | Good | Poor | Poor | Good. |
| GuB---- Guenther | Fair | Fair | Good | Good | Good | Poor | Very poor. | Fair | Good | Very poor. |
| HtB---- Hatley | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| HyB---- Hatley | Very poor. | Poor | Good | Good | Good | Poor | Very poor. | Fair | Good | Very poor. |
| KaB, KaC---- Kennan | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| KaD2---- Kennan | Poor | Good | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| KeB, KeC, KeE---- Kennan | Very poor. | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| LoB---- Loyal | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| LoC---- Loyal | Good | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| MaB---- Magnor | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| MbB, MbC---- Mahtomedi | Poor | Fair | Fair | Poor | Poor | Very poor. | Very poor. | Fair | Poor | Very poor. |
| MbE---- Mahtomedi | Very poor. | Poor | Fair | Poor | Poor | Very poor. | Very poor. | Poor | Poor | Very poor. |
| McA---- Mahtomedi | Poor | Fair | Fair | Poor | Fair | Very poor. | Very poor. | Fair | Poor | Very poor. |
| MdB---- Marathon | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| MdC---- Marathon | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| MeC---- Marathon | Poor | Poor | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| MfA---- Marshfield | Good | Good | Fair | Fair | Fair | Good | Good | Fair | Fair | Good. |
| MgA---- Meadland | Good | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| MhA---- Meadland | Very poor. | Poor | Good | Good | Good | Fair | Fair | Poor | Good | Fair. |

Table 10.--Wildlife Habitat--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herba-ceous plants | Hardwood trees | Conif-erous plants | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| Mm----------<br>Meehan | Poor | Fair | Good | Fair | Fair | Fair | Fair | Fair | Fair | Fair. |
| Mn----------<br>Minocqua | Poor | Poor | Fair | Fair | Fair | Good | Good | Poor | Fair | Good. |
| MoB, MoC----------<br>Moberg | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| MsB----------<br>Mosinee | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| MsC----------<br>Mosinee | Fair | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| MsD----------<br>Mosinee | Poor | Fair | Good | Good | Good | Very poor. | Very poor. | Fair | Good | Very poor. |
| MtC----------<br>Mosinee | Poor | Poor | Good | Good | Good | Very poor. | Very poor. | Poor | Good | Very poor. |
| MyB----------<br>Mylrea | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| MzB----------<br>Mylrea | Very poor. | Poor | Good | Good | Good | Poor | Very poor. | Very poor. | Good | Very poor. |
| Ne----------<br>Newson | Poor | Poor | Fair | Poor | Poor | Good | Good | Poor | Poor | Good. |
| Oe----------<br>Oesterle | Fair | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| Po----------<br>Plover | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |
| RbC, RbE----------<br>Ribhill | Very poor. | Poor | Good | Good | Good | Very poor. | Very poor. | Poor | Good | Very poor. |
| RcB----------<br>Rietbrock | Good | Good | Good | Good | Good | Very poor. | Very poor. | Good | Good | Very poor. |
| ReB----------<br>Rietbrock | Very poor. | Poor | Good | Good | Good | Very poor. | Very poor. | Poor | Good | Very poor. |
| RhA----------<br>Rockers | Poor | Fair | Good | Good | Good | Fair | Fair | Fair | Good | Fair. |
| RoA, RoB, RsA, RsB-<br>Rosholt | Good | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| ScA, SdA----------<br>Scott Lake | Fair | Good | Good | Good | Good | Poor | Very poor. | Good | Good | Very poor. |
| Se----------<br>Seelyeville | Poor | Poor | Fair | Fair | Poor | Good | Good | Poor | Fair | Good. |
| ShA----------<br>Sherry | Poor | Poor | Fair | Fair | Fair | Good | Good | Poor | Fair | Good. |

Table 10.--Wildlife Habitat--Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Hardwood trees | Coniferous plants | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| St---------- Sturgeon | Fair | Good | Good | Good | Good | Fair | Fair | Good | Good | Fair. |
| WtA, WtB---------- Withee | Good | Good | Good | Good | Good | Poor | Poor | Good | Good | Poor. |

**Table 11.--Building Site Development**

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| AbB<br>Alban | Severe:<br>cutbanks cave. | Slight | Moderate:<br>wetness. | Slight | Moderate:<br>frost action. | Slight. |
| Ad<br>Altdorf | Severe:<br>ponding. | Severe:<br>ponding,<br>shrink-swell. | Severe:<br>ponding,<br>shrink-swell. | Severe:<br>ponding,<br>shrink-swell. | Severe:<br>shrink-swell,<br>low strength,<br>ponding. | Severe:<br>ponding. |
| AmC<br>Amery | Severe:<br>cutbanks cave. | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Moderate:<br>slope,<br>frost action. | Moderate:<br>slope. |
| CbA<br>Cable | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding,<br>frost action. | Severe:<br>large stones,<br>ponding. |
| Ch<br>Cathro | Severe:<br>excess humus,<br>ponding. | Severe:<br>ponding,<br>subsides. | Severe:<br>ponding,<br>subsides. | Severe:<br>ponding,<br>subsides. | Severe:<br>ponding,<br>frost action,<br>subsides. | Severe:<br>ponding,<br>excess humus. |
| CkA<br>Chetek | Severe:<br>cutbanks cave. | Slight | Slight | Slight | Slight | Moderate:<br>large stones,<br>droughty. |
| CkB<br>Chetek | Severe:<br>cutbanks cave. | Slight | Slight | Moderate:<br>slope. | Slight | Moderate:<br>large stones,<br>droughty. |
| CkC<br>Chetek | Severe:<br>cutbanks cave. | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Moderate:<br>slope. | Moderate:<br>large stones,<br>droughty,<br>slope. |
| CkE<br>Chetek | Severe:<br>cutbanks cave. | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. |
| Da<br>Dancy | Severe:<br>cutbanks cave,<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding,<br>frost action. | Severe:<br>ponding. |
| DoA<br>Dolph | Severe:<br>wetness. | Severe:<br>wetness,<br>shrink-swell. | Severe:<br>wetness. | Severe:<br>wetness,<br>shrink-swell. | Severe:<br>low strength,<br>frost action,<br>shrink-swell. | Moderate:<br>wetness. |
| DuB<br>Dunnville | Severe:<br>cutbanks cave. | Severe:<br>flooding. | Severe:<br>flooding. | Severe:<br>flooding. | Moderate:<br>flooding. | Moderate:<br>droughty. |
| FeC<br>Fenwood | Moderate:<br>depth to rock,<br>slope. | Moderate:<br>shrink-swell,<br>slope. | Moderate:<br>depth to rock,<br>slope,<br>shrink-swell. | Severe:<br>slope. | Moderate:<br>slope,<br>frost action,<br>shrink-swell. | Moderate:<br>large stones,<br>slope. |
| FeD<br>Fenwood | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. | Severe:<br>slope. |

Table 11.--Building Site Development--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| FfC---Fenwood | Moderate: depth to rock, large stones, slope. | Moderate: shrink-swell, slope, large stones. | Moderate: depth to rock, slope, shrink-swell. | Severe: slope. | Moderate: slope, frost action, shrink-swell. | Severe: large stones. |
| FfE---Fenwood | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: large stones, slope. |
| FgB: | | | | | | |
| Fenwood | Moderate: depth to rock. | Moderate: shrink-swell. | Moderate: depth to rock, shrink-swell. | Moderate: shrink-swell, slope. | Moderate: frost action, shrink-swell. | Moderate: large stones. |
| Rozellville | Slight | Slight | Slight | Moderate: slope. | Moderate: frost action. | Slight. |
| Fh---Fordum | Severe: cutbanks cave, ponding. | Severe: flooding, ponding. | Severe: flooding, ponding. | Severe: flooding, ponding. | Severe: ponding, flooding, frost action. | Severe: ponding, flooding. |
| FnB---Freeon | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness, slope. | Moderate: wetness, frost action. | Slight. |
| FnC---Freeon | Severe: wetness. | Moderate: wetness, slope. | Severe: wetness. | Severe: slope. | Moderate: wetness, slope, frost action. | Moderate: slope. |
| GcB---Graycalm | Severe: cutbanks cave. | Slight | Slight | Moderate: slope. | Slight | Severe: droughty. |
| Gm---Graycalm | Severe: cutbanks cave. | Slight | Moderate: wetness. | Slight | Slight | Severe: droughty. |
| Gr---Greenwood | Severe: excess humus, ponding. | Severe: subsides, ponding, low strength. | Severe: subsides, ponding, low strength. | Severe: subsides, ponding, low strength. | Severe: ponding, frost action, subsides. | Severe: ponding, excess humus. |
| GuB---Guenther | Severe: cutbanks cave. | Slight | Moderate: wetness, shrink-swell. | Moderate: slope. | Slight | Moderate: droughty. |
| HtB---Hatley | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: small stones, large stones, wetness. |
| HyB---Hatley | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Severe: large stones. |
| KaB---Kennan | Severe: cutbanks cave. | Slight | Slight | Moderate: slope. | Moderate: frost action. | Moderate: large stones. |

Table 11.--Building Site Development--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| KaC---------- Kennan | Severe: cutbanks cave. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope, frost action. | Moderate: large stones, slope. |
| KaD2---------- Kennan | Severe: cutbanks cave, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| KeB---------- Kennan | Severe: cutbanks cave. | Moderate: large stones. | Moderate: large stones. | Moderate: slope, large stones. | Moderate: frost action, large stones. | Severe: large stones. |
| KeC---------- Kennan | Severe: cutbanks cave. | Moderate: slope, large stones. | Moderate: slope, large stones. | Severe: slope. | Moderate: slope, frost action, large stones. | Severe: large stones. |
| KeE---------- Kennan | Severe: cutbanks cave, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: large stones, slope. |
| LDF. Landfill | | | | | | |
| LoB---------- Loyal | Severe: wetness. | Moderate: wetness. | Severe: wetness. | Moderate: wetness, slope. | Moderate: wetness, frost action. | Moderate: wetness. |
| LoC---------- Loyal | Severe: wetness. | Moderate: wetness, slope. | Severe: wetness. | Severe: slope. | Moderate: wetness, slope, frost action. | Moderate: wetness, slope. |
| MaB---------- Magnor | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, frost action. | Severe: wetness. |
| MbB---------- Mahtomedi | Severe: cutbanks cave. | Slight--------- | Slight--------- | Slight--------- | Slight--------- | Moderate: small stones. |
| MbC---------- Mahtomedi | Severe: cutbanks cave. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope. | Moderate: small stones. |
| MbE---------- Mahtomedi | Severe: cutbanks cave, slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| McA---------- Mahtomedi | Severe: cutbanks cave. | Slight--------- | Moderate: wetness. | Slight--------- | Slight--------- | Moderate: small stones, droughty. |
| MdB---------- Marathon | Severe: cutbanks cave. | Slight--------- | Slight--------- | Moderate: slope. | Moderate: frost action. | Slight: |
| MdC---------- Marathon | Severe: cutbanks cave. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope, frost action. | Moderate: slope. |
| MeC---------- Marathon | Severe: cutbanks cave. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope, frost action. | Severe: large stones. |

Table 11.--Building Site Development--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| MfA--Marshfield | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: low strength, ponding, frost action. | Severe: ponding. |
| MgA--Meadland | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: large stones, wetness. |
| MhA--Meadland | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Severe: large stones. |
| Mm--Meehan | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Moderate: wetness, frost action. | Moderate: wetness, droughty. |
| Mn--Minocqua | Severe: cutbanks cave, ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding, frost action. | Severe: ponding. |
| MoB--Moberg | Severe: cutbanks cave. | Slight | Slight | Moderate: slope. | Slight | Severe: droughty. |
| MoC--Moberg | Severe: cutbanks cave. | Moderate: slope. | Moderate: slope. | Severe: slope. | Moderate: slope. | Severe: droughty. |
| MsB--Mosinee | Moderate: depth to rock, large stones. | Moderate: large stones. | Moderate: depth to rock, large stones. | Moderate: slope, large stones. | Moderate: frost action, large stones. | Moderate: large stones, droughty. |
| MsC--Mosinee | Moderate: depth to rock, large stones, slope. | Moderate: slope, large stones. | Moderate: depth to rock, slope, large stones. | Severe: slope. | Moderate: slope, frost action, large stones. | Moderate: large stones, droughty, slope. |
| MsD--Mosinee | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. | Severe: slope. |
| MtC--Mosinee | Moderate: depth to rock, large stones, slope. | Moderate: slope, large stones. | Moderate: depth to rock, slope, large stones. | Severe: slope. | Moderate: slope, frost action, large stones. | Severe: large stones, droughty. |
| MyB--Mylrea | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: wetness. |
| MzB--Mylrea | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Severe: large stones. |
| Ne--Newson | Severe: cutbanks cave, ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |
| Oe--Oesterle | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: large stones, wetness, droughty. |

Table 11.--Building Site Development--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| Pg, Ph. Pits | | | | | | |
| Po--- Plover | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: wetness. |
| RbC--- Ribhill | Severe: depth to rock, large stones. | Severe: large stones. | Severe: depth to rock, large stones. | Severe: slope, large stones. | Severe: large stones. | Severe: large stones. |
| RbE--- Ribhill | Severe: depth to rock, large stones, slope. | Severe: slope, large stones. | Severe: depth to rock, slope, large stones. | Severe: slope, large stones. | Severe: slope, large stones. | Severe: large stones, slope. |
| RcB--- Rietbrock | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: large stones, wetness, droughty. |
| ReB--- Rietbrock | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Severe: large stones. |
| RhA--- Rockers | Severe: cutbanks cave, wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: frost action. | Moderate: wetness. |
| RoA--- Rosholt | Severe: cutbanks cave. | Slight--- | Slight--- | Slight--- | Moderate: frost action. | Moderate: small stones, droughty. |
| RoB--- Rosholt | Severe: cutbanks cave. | Slight--- | Slight--- | Moderate: slope. | Moderate: frost action. | Moderate: small stones, droughty. |
| RsA--- Rosholt | Severe: cutbanks cave. | Slight--- | Slight--- | Slight--- | Moderate: frost action. | Moderate: small stones, droughty. |
| RsB--- Rosholt | Severe: cutbanks cave. | Slight--- | Slight--- | Moderate: slope. | Moderate: frost action. | Moderate: small stones, droughty. |
| ScA, SdA--- Scott Lake | Severe: cutbanks cave. | Slight--- | Moderate: wetness. | Slight--- | Moderate: frost action. | Moderate: large stones, droughty. |
| Se--- Seelyeville | Severe: excess humus, ponding. | Severe: ponding, subsides. | Severe: ponding, subsides. | Severe: ponding, subsides. | Severe: ponding, subsides. | Severe: ponding, excess humus. |
| ShA--- Sherry | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding, frost action. | Severe: ponding. |
| St--- Sturgeon | Severe: cutbanks cave, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: flooding, wetness. | Severe: wetness, flooding, frost action. | Severe: wetness. |

Table 11.--Building Site Development--Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| UoB, UoE. Udorthents | | | | | | |
| WtA, WtB---------- Withee | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness. | Severe: wetness, frost action. | Severe: wetness. |

**Table 12.--Sanitary Facilities**

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| AbB<br>Alban | Severe:<br>wetness. | Severe:<br>wetness. | Moderate:<br>wetness,<br>too sandy. | Slight | Fair:<br>too sandy,<br>wetness,<br>thin layer. |
| Ad<br>Altdorf | Severe:<br>ponding,<br>percs slowly. | Severe:<br>ponding. | Severe:<br>ponding,<br>too clayey. | Severe:<br>ponding. | Poor:<br>too clayey,<br>hard to pack,<br>ponding. |
| AmC<br>Amery | Moderate:<br>percs slowly,<br>slope. | Severe:<br>slope. | Moderate:<br>slope. | Moderate:<br>slope. | Poor:<br>small stones. |
| CbA<br>Cable | Severe:<br>ponding,<br>percs slowly. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Poor:<br>small stones,<br>ponding. |
| Ch<br>Cathro | Severe:<br>ponding,<br>percs slowly. | Severe:<br>seepage,<br>excess humus,<br>ponding. | Severe:<br>ponding. | Severe:<br>seepage,<br>ponding. | Poor:<br>ponding. |
| CkA, CkB<br>Chetek | Severe:<br>poor filter. | Severe:<br>seepage. | Severe:<br>seepage,<br>too sandy. | Severe:<br>seepage. | Poor:<br>seepage,<br>too sandy,<br>small stones. |
| CkC<br>Chetek | Severe:<br>poor filter. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage,<br>too sandy. | Severe:<br>seepage. | Poor:<br>seepage,<br>too sandy,<br>small stones. |
| CkE<br>Chetek | Severe:<br>poor filter,<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage,<br>slope,<br>too sandy. | Severe:<br>seepage,<br>slope. | Poor:<br>seepage,<br>too sandy,<br>small stones. |
| Da<br>Dancy | Severe:<br>ponding. | Severe:<br>seepage,<br>ponding. | Severe:<br>ponding. | Severe:<br>seepage,<br>ponding. | Poor:<br>small stones,<br>ponding. |
| DoA<br>Dolph | Severe:<br>wetness,<br>percs slowly. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Poor:<br>hard to pack,<br>wetness. |
| DuB<br>Dunnville | Severe:<br>wetness,<br>poor filter. | Severe:<br>seepage,<br>wetness. | Severe:<br>seepage,<br>wetness. | Severe:<br>seepage,<br>wetness. | Poor:<br>seepage,<br>too sandy. |
| FeC<br>Fenwood | Moderate:<br>thin layer,<br>seepage,<br>percs slowly. | Severe:<br>slope. | Severe:<br>depth to rock,<br>seepage. | Moderate:<br>slope. | Poor:<br>small stones. |

Table 12.--Sanitary Facilities--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| FeD---- Fenwood | Severe: slope. | Severe: slope. | Severe: depth to rock, seepage, slope. | Severe: slope. | Poor: small stones, slope. |
| FfC---- Fenwood | Moderate: thin layer, seepage, percs slowly. | Severe: slope. | Severe: depth to rock, seepage. | Moderate: slope. | Poor: small stones. |
| FfE---- Fenwood | Severe: slope. | Severe: slope. | Severe: depth to rock, seepage, slope. | Severe: slope. | Poor: small stones, slope. |
| FgB: | | | | | |
| Fenwood---- | Moderate: thin layer, seepage, percs slowly. | Moderate: seepage, depth to rock, slope. | Severe: depth to rock, seepage. | Slight---- | Poor: small stones. |
| Rozellville---- | Moderate: percs slowly. | Moderate: seepage, slope. | Moderate: large stones. | Slight---- | Poor: large stones. |
| Fh---- Fordum | Severe: flooding, ponding, poor filter. | Severe: seepage, flooding. | Severe: flooding, seepage, ponding. | Severe: flooding, seepage, ponding. | Poor: seepage, too sandy, ponding. |
| FnB---- Freeon | Severe: wetness, percs slowly. | Moderate: seepage, slope. | Moderate: wetness. | Moderate: wetness. | Fair: small stones, wetness. |
| FnC---- Freeon | Severe: wetness, percs slowly. | Severe: slope. | Moderate: wetness, slope. | Moderate: wetness, slope. | Fair: small stones, slope, wetness. |
| GcB---- Graycalm | Severe: poor filter. | Severe: seepage. | Severe: seepage, too sandy. | Severe: seepage. | Poor: seepage, too sandy. |
| Gm---- Graycalm | Severe: wetness, poor filter. | Severe: seepage, wetness. | Severe: seepage, wetness, too sandy. | Severe: seepage, wetness. | Poor: seepage, too sandy. |
| Gr---- Greenwood | Severe: subsides, ponding. | Severe: seepage, excess humus, ponding. | Severe: seepage, ponding, excess humus. | Severe: seepage, ponding. | Poor: ponding, excess humus. |
| GuB---- Guenther | Severe: wetness, poor filter. | Severe: seepage, wetness. | Moderate: wetness, too clayey. | Severe: seepage. | Poor: small stones. |
| HtB---- Hatley | Severe: wetness. | Severe: seepage, wetness. | Severe: seepage, wetness. | Severe: seepage, wetness. | Poor: seepage, small stones, wetness. |

Table 12.--Sanitary Facilities--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| HyB<br>Hatley | Severe:<br>wetness. | Severe:<br>seepage,<br>wetness. | Severe:<br>seepage,<br>wetness. | Severe:<br>seepage,<br>wetness. | Poor:<br>seepage,<br>wetness,<br>small stones. |
| KaB<br>Kennan | Slight | Severe:<br>seepage. | Severe:<br>seepage. | Slight | Fair:<br>large stones,<br>thin layer. |
| KaC<br>Kennan | Moderate:<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage. | Moderate:<br>slope. | Fair:<br>large stones,<br>slope,<br>thin layer. |
| KaD2<br>Kennan | Severe:<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>slope. | Poor:<br>slope. |
| KeB<br>Kennan | Moderate:<br>large stones. | Severe:<br>seepage. | Severe:<br>seepage. | Slight | Fair:<br>large stones,<br>thin layer. |
| KeC<br>Kennan | Moderate:<br>slope,<br>large stones. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage. | Moderate:<br>slope. | Fair:<br>large stones,<br>slope,<br>thin layer. |
| KeE<br>Kennan | Severe:<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>slope. | Poor:<br>slope. |
| LDF.<br>Landfill | | | | | |
| LoB<br>Loyal | Severe:<br>wetness,<br>percs slowly. | Moderate:<br>seepage,<br>slope. | Severe:<br>wetness. | Moderate:<br>wetness. | Fair:<br>wetness. |
| LoC<br>Loyal | Severe:<br>wetness,<br>percs slowly. | Severe:<br>slope. | Severe:<br>wetness. | Moderate:<br>wetness,<br>slope. | Fair:<br>slope,<br>wetness. |
| MaB<br>Magnor | Severe:<br>wetness,<br>percs slowly. | Moderate:<br>seepage,<br>slope. | Severe:<br>wetness. | Severe:<br>wetness. | Poor:<br>wetness. |
| MbB<br>Mahtomedi | Severe:<br>poor filter. | Severe:<br>seepage. | Severe:<br>seepage,<br>too sandy. | Severe:<br>seepage. | Poor:<br>seepage,<br>too sandy,<br>small stones. |
| MbC<br>Mahtomedi | Severe:<br>poor filter. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage,<br>too sandy. | Severe:<br>seepage. | Poor:<br>seepage,<br>too sandy,<br>small stones. |
| MbE<br>Mahtomedi | Severe:<br>poor filter,<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage,<br>slope,<br>too sandy. | Severe:<br>seepage,<br>slope. | Poor:<br>seepage,<br>too sandy,<br>small stones. |

Table 12.--Sanitary Facilities--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| McA<br>Mahtomedi | Severe:<br>wetness,<br>poor filter. | Severe:<br>seepage,<br>wetness. | Severe:<br>seepage,<br>wetness,<br>too sandy. | Severe:<br>seepage,<br>wetness. | Poor:<br>seepage,<br>too sandy,<br>small stones. |
| MdB<br>Marathon | Slight | Severe:<br>seepage. | Severe:<br>seepage. | Severe:<br>seepage. | Poor:<br>small stones. |
| MdC, MeC<br>Marathon | Moderate:<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage. | Severe:<br>seepage. | Poor:<br>small stones. |
| MfA<br>Marshfield | Severe:<br>ponding,<br>percs slowly. | Severe:<br>ponding. | Severe:<br>ponding. | Severe:<br>ponding. | Poor:<br>ponding. |
| MgA<br>Meadland | Severe:<br>wetness,<br>percs slowly. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Poor:<br>wetness,<br>small stones. |
| MhA<br>Meadland | Severe:<br>wetness,<br>percs slowly. | Severe:<br>wetness. | Severe:<br>wetness. | Severe:<br>wetness. | Poor:<br>small stones,<br>wetness. |
| Mm<br>Meehan | Severe:<br>wetness,<br>poor filter. | Severe:<br>seepage,<br>wetness. | Severe:<br>seepage,<br>wetness,<br>too sandy. | Severe:<br>seepage,<br>wetness. | Poor:<br>seepage,<br>too sandy,<br>wetness. |
| Mn<br>Minocqua | Severe:<br>ponding,<br>poor filter. | Severe:<br>seepage,<br>ponding. | Severe:<br>seepage,<br>ponding,<br>too sandy. | Severe:<br>seepage,<br>ponding. | Poor:<br>seepage,<br>too sandy,<br>small stones. |
| MoB<br>Moberg | Severe:<br>poor filter. | Severe:<br>seepage. | Severe:<br>seepage. | Severe:<br>seepage. | Poor:<br>small stones. |
| MoC<br>Moberg | Severe:<br>poor filter. | Severe:<br>seepage,<br>slope. | Severe:<br>seepage. | Severe:<br>seepage. | Poor:<br>small stones. |
| MsB<br>Mosinee | Moderate:<br>thin layer,<br>seepage. | Severe:<br>seepage. | Severe:<br>depth to rock,<br>seepage. | Severe:<br>seepage. | Poor:<br>seepage,<br>small stones. |
| MsC<br>Mosinee | Moderate:<br>thin layer,<br>seepage,<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>depth to rock,<br>seepage. | Severe:<br>seepage. | Poor:<br>seepage,<br>small stones. |
| MsD<br>Mosinee | Severe:<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>depth to rock,<br>seepage,<br>slope. | Severe:<br>seepage,<br>slope. | Poor:<br>seepage,<br>small stones,<br>slope. |
| MtC<br>Mosinee | Moderate:<br>thin layer,<br>seepage,<br>slope. | Severe:<br>seepage,<br>slope. | Severe:<br>depth to rock,<br>seepage,<br>large stones. | Severe:<br>seepage. | Poor:<br>seepage,<br>small stones. |

Table 12.--Sanitary Facilities--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| MyB, MzB---------- Mylrea | Severe: wetness, poor filter. | Severe: seepage, wetness. | Severe: seepage, wetness. | Severe: seepage, wetness. | Poor: small stones, wetness. |
| Ne---------- Newson | Severe: ponding, poor filter. | Severe: seepage, ponding. | Severe: seepage, ponding, too sandy. | Severe: seepage, ponding. | Poor: seepage, too sandy, ponding. |
| Oe---------- Oesterle | Severe: wetness, poor filter. | Severe: seepage, wetness. | Severe: seepage, wetness, too sandy. | Severe: seepage, wetness. | Poor: seepage, too sandy, small stones. |
| Pg, Ph. Pits | | | | | |
| Po---------- Plover | Severe: wetness. | Severe: wetness. | Severe: wetness, too sandy. | Severe: wetness. | Poor: too sandy, wetness. |
| RbC---------- Ribhill | Severe: thin layer, seepage, large stones. | Severe: depth to rock, seepage, slope. | Severe: depth to rock, seepage. | Moderate: seepage, slope. | Poor: area reclaim, large stones. |
| RbE---------- Ribhill | Severe: thin layer, seepage, large stones. | Severe: depth to rock, seepage, slope. | Severe: depth to rock, seepage, slope. | Severe: slope. | Poor: area reclaim, large stones, slope. |
| RcB, ReB---------- Rietbrock | Severe: wetness, percs slowly. | Severe: wetness. | Severe: depth to rock, seepage, wetness. | Severe: wetness. | Poor: small stones, wetness. |
| RhA---------- Rockers | Severe: wetness, percs slowly. | Severe: seepage, wetness. | Severe: wetness. | Severe: seepage, wetness. | Poor: wetness. |
| RoA, RoB, RsA, RsB-- Rosholt | Severe: poor filter. | Severe: seepage. | Severe: seepage, too sandy. | Severe: seepage. | Poor: seepage, too sandy, small stones. |
| ScA, SdA---------- Scott Lake | Severe: wetness, poor filter. | Severe: seepage, wetness. | Severe: seepage, wetness, too sandy. | Severe: seepage, wetness. | Poor: seepage, too sandy, small stones. |
| Se---------- Seelyeville | Severe: ponding, subsides. | Severe: seepage, excess humus, ponding. | Severe: seepage, ponding. | Severe: seepage, ponding. | Poor: ponding, excess humus. |
| ShA---------- Sherry | Severe: ponding, percs slowly. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Poor: small stones, ponding. |

Table 12.--Sanitary Facilities--Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| St<br>Sturgeon | Severe:<br>flooding,<br>wetness,<br>poor filter. | Severe:<br>seepage,<br>flooding,<br>wetness. | Severe:<br>flooding,<br>seepage,<br>wetness. | Severe:<br>flooding,<br>seepage,<br>wetness. | Poor:<br>seepage,<br>too sandy,<br>wetness. |
| UoB, UoE.<br>Udorthents | | | | | |
| WtA, WtB<br>Withee | Severe:<br>wetness,<br>percs slowly. | Moderate:<br>seepage,<br>slope. | Severe:<br>wetness. | Severe:<br>wetness. | Poor:<br>wetness. |

**Table 13.--Construction Materials**

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| AbB<br>Alban | Good | Probable | Improbable:<br>too sandy. | Good. |
| Ad<br>Altdorf | Poor:<br>wetness,<br>shrink-swell,<br>low strength. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>wetness. |
| AmC<br>Amery | Good | Probable | Probable | Poor:<br>small stones,<br>area reclaim. |
| CbA<br>Cable | Poor:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim,<br>small stones,<br>wetness. |
| Ch<br>Cathro | Poor:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>excess humus,<br>wetness. |
| CkA, CkB, CkC<br>Chetek | Good | Probable | Probable | Poor:<br>too sandy,<br>small stones,<br>area reclaim. |
| CkE<br>Chetek | Fair:<br>slope. | Probable | Probable | Poor:<br>too sandy,<br>small stones,<br>area reclaim. |
| Da<br>Dancy | Poor:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>small stones,<br>area reclaim,<br>wetness. |
| DoA<br>Dolph | Poor:<br>low strength. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>thin layer. |
| DuB<br>Dunnville | Good | Probable | Probable | Poor:<br>small stones. |
| FeC<br>Fenwood | Fair:<br>area reclaim,<br>thin layer. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim,<br>small stones. |
| FeD<br>Fenwood | Fair:<br>area reclaim,<br>thin layer,<br>slope. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim,<br>small stones,<br>slope. |
| FfC<br>Fenwood | Fair:<br>area reclaim,<br>shrink-swell. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim,<br>small stones. |

Table 13.--Construction Materials--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| FfE<br>Fenwood | Fair:<br>area reclaim,<br>shrink-swell,<br>slope. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim,<br>small stones,<br>slope. |
| FgB:<br>Fenwood | Fair:<br>area reclaim,<br>thin layer. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim,<br>small stones. |
| Rozellville | Good | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim,<br>small stones. |
| Fh<br>Fordum | Poor:<br>wetness. | Probable | Improbable:<br>too sandy. | Poor:<br>small stones,<br>wetness. |
| FnB, FnC<br>Freeon | Fair:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>small stones. |
| GcB<br>Graycalm | Good | Probable | Improbable:<br>too sandy. | Poor:<br>too sandy. |
| Gm<br>Graycalm | Fair:<br>wetness. | Probable | Improbable:<br>too sandy. | Poor:<br>too sandy. |
| Gr<br>Greenwood | Poor:<br>wetness,<br>low strength. | Improbable:<br>excess humus. | Improbable:<br>excess humus. | Poor:<br>excess humus,<br>wetness. |
| GuB<br>Guenther | Fair:<br>wetness,<br>shrink-swell. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim. |
| HtB<br>Hatley | Fair:<br>wetness. | Probable | Probable | Poor:<br>small stones,<br>area reclaim. |
| HyB<br>Hatley | Fair:<br>wetness,<br>large stones. | Probable | Probable | Poor:<br>small stones,<br>area reclaim. |
| KaB, KaC<br>Kennan | Good | Probable | Probable | Poor:<br>large stones,<br>area reclaim. |
| KaD2<br>Kennan | Fair:<br>slope. | Probable | Probable | Poor:<br>large stones,<br>area reclaim,<br>slope. |
| KeB, KeC<br>Kennan | Fair:<br>large stones. | Probable | Probable | Poor:<br>large stones,<br>area reclaim. |
| KeE<br>Kennan | Fair:<br>large stones,<br>slope. | Probable | Probable | Poor:<br>large stones,<br>slope,<br>area reclaim. |

Table 13.--Construction Materials--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| LDF. Landfill | | | | |
| LoB---- Loyal | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Fair: too clayey, small stones. |
| LoC---- Loyal | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Fair: too clayey, small stones, slope. |
| MaB---- Magnor | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, wetness. |
| MbB, MbC---- Mahtomedi | Good---- | Probable---- | Probable---- | Poor: too sandy, small stones, area reclaim. |
| MbE---- Mahtomedi | Poor: slope. | Probable---- | Probable---- | Poor: too sandy, small stones, area reclaim. |
| McA---- Mahtomedi | Fair: wetness. | Probable---- | Probable---- | Poor: small stones, area reclaim. |
| MdB, MdC, MeC--- Marathon | Good---- | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, area reclaim. |
| MfA---- Marshfield | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, area reclaim, wetness. |
| MgA, MhA---- Meadland | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, area reclaim. |
| Mm---- Meehan | Fair: wetness. | Probable---- | Improbable: too sandy. | Poor: too sandy. |
| Mn---- Minocqua | Poor: wetness. | Probable---- | Probable---- | Poor: small stones, area reclaim. |
| MoB, MoC---- Moberg | Good---- | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, area reclaim. |
| MsB, MsC---- Mosinee | Fair: area reclaim, thin layer, large stones. | Improbable: large stones. | Improbable: large stones. | Poor: small stones, area reclaim. |

Table 13.--Construction Materials--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| MsD<br>Mosinee | Fair:<br>area reclaim,<br>thin layer,<br>large stones. | Improbable:<br>large stones. | Improbable:<br>large stones. | Poor:<br>small stones,<br>area reclaim,<br>slope. |
| MtC<br>Mosinee | Fair:<br>area reclaim,<br>thin layer,<br>large stones. | Improbable:<br>large stones. | Improbable:<br>large stones. | Poor:<br>small stones,<br>area reclaim. |
| MyB<br>Mylrea | Fair:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>area reclaim. |
| MzB<br>Mylrea | Fair:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>large stones,<br>area reclaim. |
| Ne<br>Newson | Poor:<br>wetness. | Probable | Improbable:<br>too sandy. | Poor:<br>wetness. |
| Oe<br>Oesterle | Fair:<br>wetness. | Probable | Probable | Poor:<br>small stones,<br>area reclaim. |
| Pg, Ph.<br>Pits | | | | |
| Po<br>Plover | Fair:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Fair:<br>thin layer. |
| RbC<br>Ribhill | Poor:<br>area reclaim,<br>large stones. | Improbable:<br>excess fines,<br>large stones. | Improbable:<br>excess fines,<br>large stones. | Poor:<br>large stones. |
| RbE<br>Ribhill | Poor:<br>area reclaim,<br>large stones. | Improbable:<br>excess fines,<br>large stones. | Improbable:<br>excess fines,<br>large stones. | Poor:<br>large stones,<br>slope. |
| RcB, ReB<br>Rietbrock | Fair:<br>area reclaim,<br>thin layer,<br>large stones. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>small stones,<br>area reclaim. |
| RhA<br>Rockers | Fair:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>small stones. |
| RoA, RoB, RsA, RsB<br>Rosholt | Good | Probable | Probable | Poor:<br>small stones,<br>area reclaim. |
| ScA, SdA<br>Scott Lake | Fair:<br>wetness. | Probable | Probable | Poor:<br>small stones,<br>area reclaim. |
| Se<br>Seelyeville | Poor:<br>wetness,<br>low strength. | Improbable:<br>excess humus. | Improbable:<br>excess humus. | Poor:<br>excess humus,<br>wetness. |
| ShA<br>Sherry | Poor:<br>wetness. | Improbable:<br>excess fines. | Improbable:<br>excess fines. | Poor:<br>small stones,<br>area reclaim. |

Table 13.--Construction Materials--Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| St---------- Sturgeon | Poor: wetness. | Probable---------- | Improbable: too sandy. | Poor: wetness. |
| UoB, UoE. Udorthents | | | | |
| WtA, WtB---------- Withee | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: wetness. |

**Table 14.--Water Management**

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| AbB<br>Alban | Moderate: seepage, slope. | Severe: seepage, piping. | Deep to water | Rooting depth, slope. | Erodes easily, too sandy. | Erodes easily, rooting depth. |
| Ad<br>Altdorf | Moderate: seepage. | Severe: ponding. | Ponding, percs slowly, frost action. | Ponding, percs slowly, erodes easily. | Erodes easily, ponding, percs slowly. | Wetness, erodes easily, percs slowly. |
| AmC<br>Amery | Severe: slope. | Severe: seepage, piping. | Deep to water | Slope | Slope | Slope. |
| CbA<br>Cable | Moderate: seepage. | Severe: piping, ponding. | Ponding, frost action. | Large stones, ponding, droughty. | Large stones, erodes easily, ponding. | Large stones, wetness, erodes easily. |
| Ch<br>Cathro | Severe: seepage. | Severe: piping, ponding. | Ponding, subsides, frost action. | Ponding, soil blowing. | Ponding, soil blowing. | Wetness. |
| CkA<br>Chetek | Severe: seepage. | Severe: seepage. | Deep to water | Droughty, soil blowing. | Too sandy, soil blowing. | Droughty, rooting depth. |
| CkB<br>Chetek | Severe: seepage. | Severe: seepage. | Deep to water | Slope, droughty, soil blowing. | Too sandy, soil blowing. | Droughty, rooting depth. |
| CkC, CkE<br>Chetek | Severe: seepage, slope. | Severe: seepage. | Deep to water | Slope, droughty, soil blowing. | Slope, too sandy, soil blowing. | Slope, droughty, rooting depth. |
| Da<br>Dancy | Severe: seepage. | Severe: ponding. | Ponding, frost action. | Ponding, droughty. | Ponding, soil blowing. | Wetness, droughty. |
| DoA<br>Dolph | Slight | Severe: hard to pack. | Percs slowly, frost action. | Wetness, percs slowly, erodes easily. | Erodes easily, wetness. | Wetness, erodes easily, percs slowly. |
| DuB<br>Dunnville | Severe: seepage. | Severe: seepage, piping. | Deep to water | Droughty, soil blowing. | Too sandy, soil blowing. | Droughty. |
| FeC, FeD<br>Fenwood | Severe: slope. | Moderate: thin layer, large stones. | Deep to water | Slope, erodes easily. | Slope, large stones, erodes easily. | Large stones, slope, erodes easily. |
| FfC, FfE<br>Fenwood | Severe: slope. | Severe: large stones. | Deep to water | Slope, large stones, droughty. | Slope, large stones, erodes easily. | Large stones, slope, erodes easily. |
| FgB:<br>Fenwood | Moderate: seepage, depth to rock, slope. | Moderate: thin layer, large stones. | Deep to water | Slope, erodes easily. | Large stones, erodes easily. | Large stones, erodes easily. |

Table 14.--Water Management--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| FgB: Rozellville | Moderate: seepage, slope. | Severe: seepage, piping. | Deep to water | Rooting depth, slope, erodes easily. | Erodes easily | Erodes easily, rooting depth. |
| Fh: Fordum | Severe: seepage. | Severe: seepage, piping, ponding. | Ponding, flooding, frost action. | Ponding, flooding. | Ponding, too sandy. | Wetness. |
| FnB: Freeon | Moderate: slope. | Severe: seepage, piping. | Percs slowly, slope. | Slope, wetness, percs slowly. | Erodes easily, wetness, percs slowly. | Erodes easily, rooting depth. |
| FnC: Freeon | Severe: slope. | Severe: seepage, piping. | Percs slowly, slope. | Slope, wetness. | Slope, erodes easily, wetness. | Slope, erodes easily, rooting depth. |
| GcB: Graycalm | Severe: seepage. | Severe: seepage, piping. | Deep to water | Slope, droughty, fast intake. | Too sandy, soil blowing. | Droughty. |
| Gm: Graycalm | Severe: seepage. | Severe: seepage, piping. | Cutbanks cave | Wetness, droughty, fast intake. | Wetness, too sandy, soil blowing. | Droughty. |
| Gr: Greenwood | Severe: seepage. | Severe: excess humus, ponding. | Ponding, frost action. | Ponding | Ponding | Wetness. |
| GuB: Guenther | Severe: seepage. | Severe: piping. | Slope | Slope, wetness, droughty. | Wetness, soil blowing. | Droughty. |
| HtB: Hatley | Severe: seepage. | Severe: seepage, piping, wetness. | Frost action, slope, cutbanks cave. | Slope, wetness. | Large stones, wetness, too sandy. | Large stones, wetness. |
| HyB: Hatley | Severe: seepage. | Severe: seepage, wetness, piping. | Frost action, slope, cutbanks cave. | Slope, large stones, wetness. | Wetness, too sandy, large stones. | Wetness, droughty, large stones. |
| KaB: Kennan | Moderate: seepage, slope. | Severe: piping. | Deep to water | Droughty, soil blowing, slope. | Large stones, soil blowing. | Large stones, droughty. |
| KaC, KaD2: Kennan | Severe: slope. | Severe: piping. | Deep to water | Droughty, soil blowing, slope. | Slope, large stones, soil blowing. | Large stones, slope, droughty. |
| KeB: Kennan | Moderate: seepage, slope. | Severe: piping. | Deep to water | Large stones, droughty, slope. | Large stones | Large stones, droughty. |
| KeC, KeE: Kennan | Severe: slope. | Severe: piping. | Deep to water | Large stones, droughty, slope. | Slope, large stones. | Large stones, slope, droughty. |

Table 14.--Water Management--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| LDF. Landfill | | | | | | |
| LoB---- Loyal | Moderate: slope. | Moderate: piping. | Percs slowly, slope. | Slope, wetness, percs slowly. | Erodes easily, wetness, percs slowly. | Erodes easily, rooting depth. |
| LoC---- Loyal | Severe: slope. | Severe: piping. | Percs slowly, slope. | Slope, wetness, percs slowly. | Slope, erodes easily, wetness. | Slope, erodes easily, rooting depth. |
| MaB---- Magnor | Moderate: seepage, slope. | Severe: piping, wetness. | Percs slowly, frost action, slope. | Slope, wetness, percs slowly. | Erodes easily, wetness, percs slowly. | Wetness, erodes easily, rooting depth. |
| MbB---- Mahtomedi | Severe: seepage. | Severe: seepage. | Deep to water | Slope, droughty, fast intake. | Too sandy, soil blowing. | Droughty, rooting depth. |
| MbC, MbE---- Mahtomedi | Severe: seepage, slope. | Severe: seepage. | Deep to water | Slope, droughty, fast intake. | Slope, too sandy, soil blowing. | Slope, droughty, rooting depth. |
| McA---- Mahtomedi | Severe: seepage. | Severe: seepage. | Cutbanks cave | Wetness, droughty, fast intake. | Wetness, too sandy, soil blowing. | Droughty, rooting depth. |
| MdB---- Marathon | Severe: seepage. | Severe: seepage, piping. | Deep to water | Slope, erodes easily. | Erodes easily, too sandy. | Erodes easily. |
| MdC---- Marathon | Severe: seepage, slope. | Severe: seepage, piping. | Deep to water | Slope, erodes easily. | Slope, erodes easily, too sandy. | Slope, erodes easily. |
| MeC---- Marathon | Severe: seepage, slope. | Severe: seepage, piping. | Deep to water | Slope, droughty. | Slope, large stones, erodes easily. | Large stones, slope, erodes easily. |
| MfA---- Marshfield | Slight | Severe: ponding, piping. | Ponding, frost action. | Ponding, erodes easily. | Large stones, ponding, erodes easily. | Large stones, wetness, erodes easily. |
| MgA---- Meadland | Moderate: seepage. | Severe: piping. | Frost action--- | Wetness--- | Wetness--- | Wetness. |
| MhA---- Meadland | Moderate: seepage. | Severe: piping. | Frost action--- | Wetness, droughty, rooting depth. | Wetness--- | Wetness, droughty, rooting depth. |
| Mm---- Meehan | Severe: seepage. | Severe: seepage, piping, wetness. | Cutbanks cave | Wetness, droughty, fast intake. | Wetness, too sandy, soil blowing. | Wetness, droughty. |
| Mn---- Minocqua | Severe: seepage. | Severe: seepage, piping, ponding. | Ponding, frost action, cutbanks cave. | Ponding, droughty, soil blowing. | Erodes easily, ponding, too sandy. | Wetness, erodes easily, droughty. |

Table 14.--Water Management--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| MoB---------- Moberg | Severe: seepage. | Severe: seepage, piping. | Deep to water | Slope, droughty, rooting depth. | Too sandy------ | Droughty, rooting depth. |
| MoC---------- Moberg | Severe: seepage, slope. | Severe: seepage, piping. | Deep to water | Slope, droughty, rooting depth. | Slope, too sandy. | Slope, droughty, rooting depth. |
| MsB---------- Mosinee | Severe: seepage. | Severe: seepage, large stones. | Deep to water | Slope, large stones, droughty. | Large stones, soil blowing. | Large stones, droughty. |
| MsC, MsD---------- Mosinee | Severe: seepage, slope. | Severe: seepage, large stones. | Deep to water | Slope, large stones, droughty. | Slope, large stones, soil blowing. | Large stones, slope, droughty. |
| MtC---------- Mosinee | Severe: seepage, slope. | Severe: seepage, large stones. | Deep to water | Large stones, droughty, slope. | Slope, large stones. | Large stones, slope, droughty. |
| MyB---------- Mylrea | Severe: seepage. | Severe: seepage, piping, wetness. | Frost action, slope, cutbanks cave. | Slope, wetness, erodes easily. | Erodes easily, wetness, too sandy. | Wetness, erodes easily. |
| MzB---------- Mylrea | Severe: seepage. | Severe: seepage, piping, wetness. | Frost action, slope, cutbanks cave. | Slope, wetness. | Large stones, erodes easily, wetness. | Large stones, wetness, erodes easily. |
| Ne---------- Newson | Severe: seepage. | Severe: seepage, piping, ponding. | Ponding, cutbanks cave. | Ponding, droughty, fast intake. | Ponding, too sandy, soil blowing. | Wetness, droughty. |
| Oe---------- Oesterle | Severe: seepage. | Severe: seepage, piping, wetness. | Frost action, cutbanks cave. | Wetness, droughty. | Wetness, too sandy. | Wetness, droughty. |
| Pg, Ph. Pits | | | | | | |
| Po---------- Plover | Moderate: seepage. | Severe: piping, wetness. | Frost action, cutbanks cave. | Wetness, soil blowing. | Wetness, too sandy. | Wetness. |
| RbC, RbE---------- Ribhill | Severe: slope. | Severe: piping, large stones. | Deep to water | Slope, large stones, thin layer. | Slope, large stones, depth to rock. | Large stones, slope, depth to rock. |
| RcB---------- Rietbrock | Moderate: seepage, depth to rock, slope. | Moderate: thin layer, piping, large stones. | Large stones, frost action, slope. | Slope, large stones, wetness. | Large stones, wetness, erodes easily. | Large stones, wetness, erodes easily. |
| ReB---------- Rietbrock | Moderate: seepage, depth to rock, slope. | Severe: thin layer. | Large stones, frost action, slope. | Slope, large stones, wetness. | Large stones, erodes easily, wetness. | Large stones, wetness, erodes easily. |

Table 14.--Water Management--Continued

| Soil name and map symbol | Limitations for-- Pond reservoir areas | Embankments, dikes, and levees | Features affecting-- Drainage | Irrigation | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|---|
| RhA---------- Rockers | Severe: seepage. | Severe: wetness. | Frost action--- | Wetness, fast intake, soil blowing. | Wetness, soil blowing. | Wetness. |
| RoA---------- Rosholt | Severe: seepage. | Severe: seepage, piping. | Deep to water | Droughty, soil blowing. | Too sandy, soil blowing. | Droughty. |
| RoB---------- Rosholt | Severe: seepage. | Severe: seepage, piping. | Deep to water | Droughty, soil blowing, slope. | Too sandy, soil blowing. | Droughty. |
| RsA---------- Rosholt | Severe: seepage. | Severe: seepage, piping. | Deep to water | Droughty------- | Too sandy------ | Droughty. |
| RsB---------- Rosholt | Severe: seepage. | Severe: seepage, piping. | Deep to water | Droughty, slope. | Too sandy------ | Droughty. |
| ScA, SdA---------- Scott Lake | Severe: seepage. | Severe: seepage, piping. | Large stones, cutbanks cave. | Wetness, droughty. | Large stones, wetness, too sandy. | Large stones, droughty, rooting depth. |
| Se---------- Seelyeville | Severe: seepage. | Severe: excess humus, ponding. | Ponding, subsides. | Ponding-------- | Ponding-------- | Wetness. |
| ShA---------- Sherry | Moderate: seepage. | Severe: piping, ponding. | Ponding, frost action. | Ponding, rooting depth. | Erodes easily, ponding. | Wetness, erodes easily, rooting depth. |
| St---------- Sturgeon | Severe: seepage. | Severe: seepage, piping, wetness. | Flooding, frost action, cutbanks cave. | Wetness-------- | Erodes easily, wetness, too sandy. | Wetness, erodes easily. |
| UoB, UoE. Udorthents | | | | | | |
| WtA, WtB---------- Withee | Moderate: seepage, slope. | Severe: wetness. | Percs slowly, frost action, slope. | Slope, wetness, percs slowly. | Erodes easily, wetness, percs slowly. | Wetness, erodes easily, rooting depth. |

**Table 15.--Engineering Index Properties**

**(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)**

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| AbB---------- Alban | 0-7 | Loam---------- | ML, CL-ML | A-4 | 0 | 100 | 100 | 85-100 | 60-80 | <25 | 3-6 |
| | 7-22 | Loam, fine sandy loam, silt loam. | SM, SC, ML, CL | A-2, A-4 | 0 | 100 | 100 | 50-100 | 15-90 | <25 | NP-8 |
| | 22-38 | Fine sandy loam, sandy loam, loam. | SM, SC, ML, CL | A-2, A-4 | 0 | 100 | 100 | 60-100 | 30-75 | <25 | NP-8 |
| | 38-60 | Stratified fine sand to silt loam. | SM, ML, CL-ML, SP-SM | A-4, A-2, A-3 | 0 | 100 | 100 | 70-100 | 5-100 | <25 | NP-6 |
| Ad---------- Altdorf | 0-3 | Mucky silt loam | ML, CL, CL-ML | A-4 | 0 | 95-100 | 95-100 | 85-100 | 70-90 | 20-30 | 3-10 |
| | 3-12 | Silt loam, silty clay loam. | CL | A-6 | 0 | 95-100 | 95-100 | 85-100 | 70-95 | 25-40 | 10-20 |
| | 12-60 | Clay loam, clay, silty clay. | CH, CL | A-7 | 0 | 90-100 | 90-100 | 80-100 | 65-95 | 41-65 | 25-40 |
| AmC---------- Amery | 0-8 | Silt loam-------- | ML, CL-ML, SM, SM-SC | A-4 | 0-5 | 80-100 | 75-100 | 65-100 | 45-95 | <25 | 1-7 |
| | 8-34 | Sandy loam, fine sandy loam, loam. | SM, SC, CL, ML | A-4, A-2, A-1 | 3-15 | 50-100 | 50-85 | 30-85 | 15-75 | <28 | NP-9 |
| | 34-60 | Loamy sand, sandy loam, gravelly sandy loam. | SM, SC, SP-SM, SP-SC | A-4, A-2, A-1 | 3-15 | 50-100 | 50-85 | 25-85 | 10-50 | <28 | NP-9 |
| CbA---------- Cable | 0-6 | Silt loam-------- | CL, CL-ML, SC, SM-SC | A-4 | 25-50 | 75-100 | 75-100 | 60-100 | 35-90 | <26 | 5-10 |
| | 6-20 | Silt loam, loam, fine sandy loam. | SM, SC, ML, CL | A-2, A-4 | 0-25 | 75-100 | 75-100 | 50-100 | 30-90 | <33 | NP-10 |
| | 20-30 | Loam, sandy loam, gravelly sandy loam. | SM, SC, ML, CL | A-2, A-4, A-1 | 0-25 | 65-100 | 60-100 | 35-95 | 20-75 | <27 | NP-8 |
| | 30-60 | Sandy loam, gravelly sandy loam, loamy sand. | SM, GM, ML, CL-ML | A-2, A-1, A-4 | 0-25 | 65-100 | 60-100 | 40-90 | 20-70 | <23 | NP-6 |
| Ch---------- Cathro | 0-5 | Hemic material--- | PT | A-8 | 0 | --- | --- | --- | --- | --- | --- |
| | 5-28 | Sapric material, muck. | PT | A-8 | 0 | --- | --- | --- | --- | --- | --- |
| | 28-60 | Loam, silt loam, clay loam. | SM-SC, CL-ML, SC, CL | A-4, A-6 | 0-5 | 80-100 | 65-100 | 60-100 | 35-90 | 20-40 | 4-20 |
| CkA, CkB, CkC, CkE---------- Chetek | 0-8 | Sandy loam------- | SM, SM-SC | A-2, A-4 | 0-15 | 80-100 | 75-100 | 45-70 | 25-40 | <23 | NP-6 |
| | 8-13 | Sandy loam, loam | ML, CL, SM, SC | A-2, A-4 | 0-15 | 80-100 | 75-100 | 45-95 | 25-75 | <26 | NP-8 |
| | 13-19 | Sandy loam, loam | ML, CL, SM, SC | A-2, A-4, A-6, A-1 | 0-15 | 80-100 | 75-100 | 45-95 | 10-75 | <31 | NP-13 |
| | 19-60 | Stratified sand to gravel. | SP, SP-SM | A-1 | 0-15 | 55-95 | 45-75 | 15-50 | 1-5 | --- | NP |

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Da<br>Dancy | 0-4 | Sandy loam | SM, SM-SC | A-2, A-4 | 0-15 | 85-100 | 85-100 | 50-70 | 25-40 | <25 | 2-7 |
| | 4-21 | Loamy sand, sandy loam. | SM, SC, ML, CL | A-2, A-4, A-1 | 0-15 | 85-100 | 85-100 | 45-85 | 15-55 | <26 | 1-8 |
| | 21-41 | Clay loam, loam, gravelly sandy clay loam. | SC, CL, GC | A-2, A-4, A-6 | 0-15 | 55-100 | 55-100 | 55-100 | 25-80 | 25-40 | 9-18 |
| | 41-60 | Sandy loam, loam, gravelly clay loam. | SC, CL, GC | A-2, A-4, A-6 | 0-15 | 55-100 | 55-100 | 40-100 | 15-80 | 25-40 | 7-18 |
| DoA<br>Dolph | 0-9 | Silt loam | CL, CL-ML, ML | A-4 | 0 | 100 | 100 | 90-100 | 85-95 | 20-30 | 3-10 |
| | 9-15 | Silty clay loam, silt loam. | CL, CL-ML, ML | A-6, A-7, A-4 | 0 | 100 | 100 | 90-100 | 85-95 | 25-45 | 3-22 |
| | 15-37 | Clay, clay loam | CL, CH | A-7 | 0 | 90-100 | 90-100 | 80-100 | 65-95 | 41-86 | 20-57 |
| | 37-60 | Clay loam, sandy clay loam. | CL, SC, CH | A-6, A-7, A-2 | 0 | 90-100 | 90-100 | 70-100 | 30-95 | 35-77 | 15-51 |
| DuB<br>Dunnville | 0-8 | Fine sandy loam | SM, ML | A-2, A-4 | 0 | 95-100 | 90-100 | 55-95 | 30-65 | <20 | NP-4 |
| | 8-26 | Loam, sandy loam, fine sandy loam. | CL, CL-ML, SC, SM-SC | A-2, A-4 | 0 | 95-100 | 90-100 | 55-95 | 30-75 | 20-30 | 4-9 |
| | 26-36 | Sandy loam, fine sandy loam, loamy fine sand. | SM, ML | A-2, A-4 | 0 | 95-100 | 90-100 | 55-85 | 30-55 | <20 | NP-4 |
| | 36-60 | Sand, gravelly sand, fine sand. | SP, SM, GP, GM | A-2, A-3, A-1 | 0 | 50-100 | 50-100 | 25-70 | 2-20 | --- | NP |
| FeC, FeD<br>Fenwood | 0-8 | Silt loam | ML, CL-ML, CL | A-4 | 0-15 | 90-100 | 85-100 | 85-100 | 85-100 | 20-30 | 3-8 |
| | 8-18 | Loam, sandy loam, silt loam. | ML, CL-ML, SM, SM-SC | A-4, A-2, A-1 | 0-15 | 80-100 | 75-95 | 45-95 | 20-95 | <25 | 2-7 |
| | 18-31 | Loam, gravelly loam, sandy clay loam. | CL, SC, GC | A-6, A-4, A-2 | 0-15 | 55-95 | 50-95 | 40-95 | 20-75 | 25-40 | 9-18 |
| | 31-43 | Very cobbly loam, cobbly loam, cobbly sandy clay loam. | CL, SC, GC, CL-ML | A-6, A-4, A-2, A-1 | 7-50 | 55-95 | 50-90 | 40-85 | 15-70 | 15-40 | 4-18 |
| | 43 | Weathered bedrock, unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| FfC, FfE<br>Fenwood | 0-9 | Silt loam | ML, CL-ML, CL | A-4 | 25-50 | 90-100 | 85-100 | 85-100 | 85-100 | 20-30 | 3-8 |
| | 9-15 | Loam, sandy loam, silt loam. | ML, CL-ML, SM, SM-SC | A-4, A-2, A-1 | 0-25 | 80-100 | 75-95 | 45-95 | 20-95 | <25 | 2-7 |
| | 15-27 | Loam, gravelly loam, sandy clay loam. | CL, SC, GC | A-6, A-4, A-2 | 0-25 | 55-95 | 50-95 | 40-95 | 20-75 | 25-40 | 9-18 |
| | 27-45 | Very cobbly loam, cobbly loam, cobbly sandy clay loam. | CL, SC, GC, CL-ML | A-6, A-4, A-2, A-1 | 7-50 | 55-95 | 50-95 | 40-85 | 15-70 | 15-40 | 4-18 |
| | 45 | Weathered bedrock, unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| FgB: | | | | | | | | | | | |
| Fenwood--------- | 0-8 | Silt loam-------- | ML, CL-ML, CL | A-4 | 0-7 | 90-100 | 85-100 | 85-100 | 85-100 | 20-30 | 3-8 |
| | 8-18 | Loam, sandy loam, silt loam. | ML, CL-ML, SM, SM-SC | A-4, A-2, A-1 | 0-7 | 80-100 | 75-95 | 45-95 | 20-95 | <25 | 2-7 |
| | 18-31 | Loam, gravelly loam, clay loam. | CL, SC, GC | A-6, A-4, A-2 | 0-7 | 55-95 | 50-95 | 40-95 | 20-75 | 25-40 | 9-18 |
| | 31-43 | Very cobbly loam, cobbly loam, cobbly sandy clay loam. | CL, SC, GC, CL-ML | A-6, A-4, A-2, A-1 | 7-50 | 55-95 | 50-90 | 40-85 | 15-70 | 15-40 | 4-18 |
| | 43 | Weathered bedrock, unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rozellville----- | 0-9 | Silt loam-------- | ML, CL, SM, SC | A-4, A-6 | 0-7 | 75-100 | 75-100 | 65-100 | 45-100 | <30 | 2-12 |
| | 9-14 | Silt loam, loam | SM, SC, ML, CL | A-4, A-6 | 0-7 | 75-100 | 75-100 | 65-100 | 45-100 | <35 | NP-13 |
| | 14-35 | Loam, sandy loam, clay loam. | SC, CL, SM, ML | A-2, A-4, A-6, A-1 | 0-7 | 75-100 | 75-100 | 45-100 | 20-85 | <40 | NP-18 |
| | 35-60 | Gravelly loam, cobbly loam, gravelly sandy loam. | GM, SM, SM-SC, ML | A-1, A-2, A-4, A-6 | 0-50 | 40-100 | 40-100 | 25-95 | 12-75 | <40 | NP-13 |
| Fh--------------- | 0-6 | Silt loam-------- | ML, CL, SM, SC | A-4, A-6 | 0-15 | 80-100 | 70-100 | 65-100 | 45-95 | 20-35 | 3-15 |
| Fordum | 6-30 | Silt loam, fine sandy loam, loam. | SM, SC, ML, CL | A-2, A-4, A-1 | 0-15 | 80-100 | 70-100 | 45-100 | 20-90 | <30 | 3-10 |
| | 30-60 | Sand, fine sand, loamy fine sand. | SP, SM | A-3, A-2, A-1 | 0-15 | 80-100 | 70-100 | 35-80 | 2-35 | --- | NP |
| FnB, FnC--------- | 0-9 | Silt loam-------- | ML, CL, CL-ML | A-4 | 0-5 | 90-100 | 90-100 | 85-100 | 85-100 | <30 | 1-10 |
| Freeon | 9-16 | Silt loam-------- | ML, CL, CL-ML | A-4 | 0-5 | 90-100 | 90-100 | 85-100 | 85-100 | <30 | 1-10 |
| | 16-21 | Silt loam-------- | ML, CL, CL-ML | A-4 | 0-5 | 90-100 | 90-100 | 85-100 | 85-100 | <30 | 1-10 |
| | 21-35 | Loam, gravelly sandy loam, gravelly loam. | SM, SC, ML, CL | A-4, A-6, A-2, A-1 | 0-15 | 65-100 | 65-95 | 35-90 | 10-70 | <35 | NP-15 |
| | 35-60 | Sandy loam, loam, gravelly sandy loam. | SM, SC, ML, CL | A-4, A-2, A-6, A-1 | 0-15 | 65-95 | 60-95 | 35-90 | 10-70 | <35 | NP-15 |
| GcB--------------- | 0-9 | Loamy sand------- | SP-SM, SM | A-2, A-1 | 0 | 95-100 | 75-100 | 35-75 | 10-30 | --- | NP |
| Graycalm | 9-26 | Sand, loamy sand | SP-SM, SM, SP | A-3, A-2, A-1 | 0 | 95-100 | 75-100 | 30-75 | 0-30 | --- | NP |
| | 26-52 | Sand, loamy sand, loamy fine sand. | SM, SP-SM, SP | A-2, A-1, A-3 | 0 | 95-100 | 75-100 | 30-85 | 0-45 | --- | NP |
| | 52-60 | Sand------------- | SP, SP-SM, SM | A-2, A-1, A-3 | 0 | 95-100 | 75-100 | 35-55 | 0-15 | --- | NP |

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Gm | 0-9 | Loamy sand | SP-SM, SM | A-2, A-1 | 0 | 95-100 | 75-100 | 35-75 | 10-30 | --- | NP |
| Graycalm | 9-25 | Sand, loamy sand | SP-SM, SM, SP | A-3, A-2, A-1 | 0 | 95-100 | 75-100 | 30-75 | 0-30 | --- | NP |
| | 25-49 | Sand, loamy sand, loamy fine sand. | SM, SP-SM, SP | A-2, A-1, A-3 | 0 | 95-100 | 75-100 | 30-85 | 0-45 | --- | NP |
| | 49-60 | Sand, coarse sand | SP, SP-SM, SM | A-2, A-1, A-3 | 0 | 95-100 | 75-100 | 35-55 | 0-15 | --- | NP |
| Gr | 0-4 | Fibric material | PT | A-8 | 0 | --- | --- | --- | --- | --- | --- |
| Greenwood | 4-60 | Hemic material | PT | A-8 | 0 | --- | --- | --- | --- | --- | --- |
| GuB | 0-9 | Loamy sand | SM | A-2, A-1 | 0 | 90-100 | 90-100 | 45-75 | 15-30 | --- | NP |
| Guenther | 9-31 | Loamy sand, sand | SP-SM, SM | A-3, A-2, A-1 | 0 | 90-100 | 90-100 | 45-75 | 5-30 | --- | NP |
| | 31-37 | Fine sandy loam, loam, sandy loam. | SC, CL | A-2, A-4, A-6 | 0-15 | 90-100 | 85-100 | 50-100 | 25-80 | 25-40 | 9-18 |
| | 37-60 | Gravelly loam, gravelly sandy loam, sandy loam. | SM, SC, ML, CL | A-2, A-4, A-6 | 0-15 | 60-100 | 55-100 | 50-100 | 25-80 | 16-40 | 2-18 |
| HtB | 0-8 | Silt loam | CL, CL-ML, SC, SM-SC | A-4 | 0-25 | 75-100 | 70-100 | 60-100 | 40-90 | <26 | 6-8 |
| Hatley | 8-13 | Cobbly silt loam, loam, gravelly loamy sand. | ML, CL-ML, SM-SC, SM | A-4, A-2, A-1-b | 0-25 | 75-100 | 70-100 | 35-100 | 10-90 | <26 | NP-6 |
| | 13-30 | Loam, sandy loam, cobbly loam. | SC, SM, CL, ML | A-1, A-2, A-4 | 0-25 | 75-100 | 70-100 | 40-100 | 20-90 | <30 | NP-10 |
| | 30-60 | Loamy sand, sandy loam, gravelly loamy sand. | SM, SP-SM | A-1, A-2 | 0-25 | 70-95 | 60-95 | 30-70 | 10-35 | <20 | NP-4 |
| HyB | 0-5 | Cobbly silt loam | CL, CL-ML, SC, SM-SC | A-4 | 25-50 | 75-100 | 70-100 | 60-100 | 40-90 | <26 | 6-8 |
| Hatley | 5-14 | Cobbly silt loam, silt loam, loam. | ML, CL-ML, SM-SC, SM | A-4, A-2, A-1-b | 0-25 | 75-100 | 70-100 | 35-100 | 10-90 | <26 | NP-6 |
| | 14-32 | Loam, sandy loam, gravelly sandy loam. | SC, SM, CL, ML | A-1, A-2, A-4 | 0-25 | 75-100 | 70-100 | 40-100 | 20-90 | <30 | NP-10 |
| | 32-60 | Loamy sand, sandy loam, gravelly loamy sand. | SM, SP-SM | A-1, A-2 | 0-25 | 70-95 | 60-95 | 30-70 | 10-35 | <20 | NP-4 |
| KaB, KaC, KaD2 | 0-8 | Sandy loam | SM, SM-SC, ML, CL-ML | A-2, A-4, A-1 | 0-25 | 75-100 | 75-100 | 45-85 | 20-55 | <23 | 2-6 |
| Kennan | 8-16 | Sandy loam, silt loam, loamy sand. | SM, SM-SC, ML, CL-ML | A-4, A-2, A-1-b | 0-25 | 75-100 | 75-100 | 35-100 | 12-90 | <23 | NP-6 |
| | 16-40 | Sandy loam, fine sandy loam, loam. | SM, SC, ML, CL | A-2, A-4, A-1 | 0-25 | 75-100 | 75-100 | 40-100 | 20-90 | <30 | NP-10 |
| | 40-48 | Sandy loam, loam, loamy sand. | SM, SC, ML, CL | A-2, A-4, A-1 | 0-25 | 75-95 | 70-95 | 40-90 | 12-70 | <30 | NP-9 |
| | 48-60 | Loamy sand, sandy loam, gravelly loamy sand. | SP-SM, SM, SM-SC | A-1-b, A-2 | 0-25 | 65-95 | 60-85 | 30-70 | 10-25 | <20 | NP-5 |

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| KeB, KeC, KeE---- | 0-3 | Sandy loam------- | SM-SC, SM, ML, CL-ML | A-2, A-4, A-1 | 25-50 | 75-100 | 75-100 | 45-85 | 20-55 | <23 | 2-6 |
| Kennan | 3-21 | Sandy loam, silt loam, loamy sand. | SM, SM-SC, ML, CL-ML | A-1-b, A-2, A-4 | 0-25 | 75-100 | 75-100 | 35-100 | 12-90 | <25 | NP-6 |
| | 21-44 | Sandy loam, fine sandy loam, loam. | SM, ML, CL, SM | A-4, A-1, A-2 | 0-25 | 75-100 | 75-100 | 40-100 | 20-90 | <30 | NP-10 |
| | 44-56 | Sandy loam, loam, loamy sand. | SM, SC, ML, CL | A-2, A-4, A-1 | 0-25 | 75-95 | 70-95 | 40-90 | 12-70 | <30 | NP-9 |
| | 56-60 | Loamy sand, sandy loam, gravelly loamy sand. | SP-SM, SM, SM-SC | A-1-b, A-2-4 | 0-25 | 65-95 | 60-95 | 30-70 | 10-25 | <20 | NP-5 |
| LDF. | | | | | | | | | | | |
| Landfill | | | | | | | | | | | |
| LoB, LoC--------- | 0-9 | Silt loam-------- | CL, CL-ML | A-4 | 0-9 | 90-100 | 85-100 | 75-100 | 70-85 | 21-26 | 4-8 |
| Loyal | 9-20 | Silt loam-------- | CL, CL-ML | A-4, A-6 | 0-9 | 90-100 | 85-100 | 75-100 | 70-85 | 21-35 | 4-15 |
| | 20-49 | Loam, sandy clay loam, clay loam. | SC, CL | A-4, A-6 | 0-15 | 55-100 | 50-90 | 25-75 | 15-60 | 25-32 | 7-15 |
| | 49-60 | Loam, sandy clay loam, sandy loam. | SC, SC-SM, CL, CL-ML | A-2, A-4, A-6 | 0-15 | 55-100 | 50-90 | 25-75 | 15-60 | 25-32 | 7-13 |
| MaB---------- | 0-10 | Silt loam-------- | CL, CL-ML, ML | A-4 | 0-15 | 95-100 | 90-100 | 85-100 | 65-100 | <28 | 2-10 |
| Magnor | 10-16 | Silt loam, silt | CL, CL-ML, ML | A-4 | 0-15 | 95-100 | 90-100 | 85-100 | 65-100 | <35 | NP-10 |
| | 16-50 | Loam, sandy loam, gravelly sandy loam. | ML, CL-ML, SM, SM-SC | A-2, A-4, A-1 | 0-15 | 75-100 | 70-100 | 40-90 | 20-70 | <25 | NP-7 |
| | 50-60 | Sandy loam, loam, gravelly sandy loam. | ML, CL-ML, SM, SM-SC | A-2, A-4, A-1 | 0-15 | 75-100 | 70-100 | 40-90 | 20-70 | <25 | NP-6 |
| MbB, MbC, MbE---- | 0-8 | Loamy sand------- | SM, SM-SC | A-2, A-1 | 0-2 | 95-100 | 60-90 | 40-85 | 15-30 | <20 | NP-4 |
| Mahtomedi | 8-24 | Loamy sand, sand, gravelly loamy sand. | SP-SM, SM | A-2, A-3, A-1 | 0-15 | 70-95 | 50-90 | 30-70 | 5-25 | <20 | NP |
| | 24-60 | Sand, gravelly coarse sand, gravelly sand. | SP, SM, SP-SM | A-2, A-3, A-1 | 0-15 | 55-95 | 50-90 | 30-70 | 2-15 | <20 | NP |
| McA---------- | 0-7 | Loamy sand------- | SM, SP-SM | A-2, A-1 | 0-2 | 95-100 | 60-90 | 40-85 | 10-25 | <20 | NP-4 |
| Mahtomedi | 7-19 | Loamy coarse sand, loamy sand, gravelly loamy sand. | SM, SP-SM | A-2, A-1 | 0-2 | 75-95 | 60-90 | 30-70 | 10-25 | <20 | NP-4 |
| | 19-37 | Gravelly coarse sand, coarse sand, sand. | SP-SM, SM | A-2, A-3, A-1 | 0-15 | 70-95 | 50-90 | 30-70 | 5-15 | <20 | NP |
| | 37-60 | Gravelly sand, gravelly coarse sand, coarse sand. | SP, SM, SP-SM | A-2, A-3, A-1 | 0-15 | 55-95 | 50-90 | 30-70 | 2-15 | <20 | NP |

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| MdB*, MdC*<br>Marathon | 0-7 | Silt loam | ML, CL-ML, CL | A-4, A-6 | 0-3 | 80-100 | 75-100 | 70-100 | 55-100 | 17-32 | 1-13 |
| | 7-18 | Silt loam | ML, CL-ML | A-4 | 0-3 | 80-100 | 75-100 | 70-100 | 70-100 | <20 | 1-6 |
| | 18-29 | Silt loam, very fine sandy loam. | CL, CL-ML, SC, SM-SC | A-4 | 0-3 | 80-100 | 75-100 | 65-100 | 35-100 | 20-30 | 4-9 |
| | 29-38 | Very gravelly coarse sandy loam, gravelly loam, very gravelly sandy loam. | GM, GC, SM, SC | A-2, A-1 | 0-10 | 30-85 | 25-55 | 15-40 | 12-30 | <26 | NP-8 |
| | 38-57 | Extremely gravelly loamy coarse sand, very gravelly coarse sandy loam. | SM | A-1 | 0 | 70-100 | 40-100 | 20-30 | 12-20 | --- | NP |
| | 57-60 | Extremely gravelly loamy coarse sand, very gravelly loamy coarse sand. | SM | A-1 | 0 | 70-100 | 40-100 | 20-30 | 12-20 | --- | NP |
| MeC*<br>Marathon | 0-4 | Silt loam | ML, CL-ML, CL | A-4, A-6 | 25-50 | 80-100 | 75-100 | 70-100 | 55-100 | 17-32 | 1-13 |
| | 4-12 | Silt loam | ML, CL-ML | A-4 | 0-25 | 80-100 | 75-100 | 70-100 | 70-100 | <20 | 1-6 |
| | 12-18 | Silt loam, very fine sandy loam. | CL, CL-ML, SC, SM-SC | A-4 | 0-25 | 80-100 | 75-100 | 65-100 | 35-100 | 20-30 | 4-9 |
| | 18-26 | Gravelly coarse sandy loam, gravelly loam, very gravelly sandy loam. | GM, GC, SM, SC | A-2, A-1 | 0-10 | 30-100 | 25-55 | 20-40 | 12-30 | <26 | NP-8 |
| | 26-41 | Extremely gravelly loamy coarse sand, very gravelly coarse sandy loam. | SM | A-1 | 0 | 70-100 | 40-100 | 20-30 | 12-20 | --- | NP |
| | 41-60 | Extremely gravelly loamy coarse sand, very gravelly loamy coarse sand. | SM | A-1 | 0 | 70-100 | 40-100 | 20-30 | 12-20 | --- | NP |
| MfA<br>Marshfield | 0-8 | Silt loam | CL | A-4, A-6 | 0-25 | 80-100 | 75-100 | 70-100 | 60-100 | 25-35 | 7-15 |
| | 8-16 | Silt loam, silt | ML, CL-ML, CL | A-4, A-6 | 0-25 | 80-100 | 75-100 | 70-100 | 60-100 | 15-35 | 3-14 |
| | 16-23 | Silt loam, silty clay loam. | CL | A-6, A-4 | 0-25 | 80-100 | 75-100 | 70-100 | 70-95 | 25-40 | 9-21 |
| | 23-34 | Loam, sandy clay loam, clay loam. | CL | A-6, A-4 | 0-25 | 80-100 | 75-100 | 70-100 | 50-95 | 25-40 | 8-21 |
| | 34-60 | Sandy loam, silty clay loam, clay loam. | CL, ML, SC, SM | A-4, A-6, A-2 | 0-25 | 80-100 | 75-100 | 50-100 | 25-85 | 15-40 | 2-20 |

See footnote at end of table.

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| MgA--------------<br>Meadland | 0-7 | Loam------------ | CL-ML,<br>SM-SC | A-4 | 0-8 | 75-100 | 75-100 | 65-100 | 45-90 | <20 | 4-7 |
| | 7-16 | Sandy loam, loam, silt loam. | CL, ML,<br>SC, SM | A-2, A-4,<br>A-6,<br>A-1-b | 0-8 | 75-100 | 75-100 | 45-100 | 20-90 | <30 | NP-11 |
| | 16-41 | Loam, sandy loam, clay loam. | CL, SC,<br>ML, SM | A-2, A-4,<br>A-6, A-7 | 0-8 | 75-100 | 75-100 | 45-100 | 20-80 | <50 | NP-25 |
| | 41-60 | Gravelly loam, sandy loam, gravelly sandy clay loam. | ML, CL,<br>SC, GC | A-2, A-4,<br>A-6, A-7 | 0-8 | 55-100 | 55-100 | 25-100 | 15-80 | <45 | NP-25 |
| MhA--------------<br>Meadland | 0-5 | Loam------------ | CL-ML,<br>SM-SC | A-4 | 25-50 | 75-100 | 75-100 | 65-100 | 45-90 | <20 | 4-7 |
| | 5-15 | Sandy loam, loam, silt loam. | CL, ML,<br>SC, SM | A-2, A-4,<br>A-6, A-1 | 0-8 | 75-100 | 75-100 | 45-100 | 20-90 | <30 | NP-11 |
| | 15-25 | Loam, sandy loam, clay loam. | CL, SC,<br>ML, SM | A-2, A-4,<br>A-6, A-7 | 0-8 | 75-100 | 75-100 | 45-100 | 20-80 | <50 | NP-25 |
| | 25-60 | Loam, sandy loam, gravelly sandy clay loam. | ML, CL,<br>SC, GC | A-2, A-4,<br>A-6, A-7 | 0-8 | 55-100 | 55-100 | 25-100 | 15-80 | <45 | NP-25 |
| Mm---------------<br>Meehan | 0-10 | Loamy sand------- | SM | A-2, A-1 | 0 | 90-100 | 75-100 | 40-90 | 15-30 | --- | NP |
| | 10-30 | Sand, loamy sand | SM, SP-SM,<br>SP | A-1, A-2,<br>A-3 | 0 | 90-100 | 75-100 | 40-90 | 3-30 | --- | NP |
| | 30-60 | Sand------------- | SP, SP-SM | A-1, A-3,<br>A-2 | 0 | 90-100 | 75-100 | 40-90 | 0-5 | --- | NP |
| Mn---------------<br>Minocqua | 0-5 | Sandy loam------- | SM, SM-SC,<br>ML, CL-ML | A-2, A-4 | 0-7 | 80-100 | 75-100 | 45-85 | 25-55 | <20 | NP-7 |
| | 5-19 | Silt loam, loam, sandy loam. | SC, SM,<br>CL, ML | A-2, A-4,<br>A-6 | 0-7 | 80-100 | 75-100 | 45-100 | 25-90 | <35 | NP-13 |
| | 19-23 | Loamy coarse sand, gravelly loamy sand, gravelly sandy loam. | SM, GM,<br>GP, SP | A-2, A-1,<br>A-3, A-4 | 0-7 | 50-100 | 50-100 | 5-70 | 2-40 | <20 | NP-4 |
| | 23-60 | Gravelly coarse sand, sand, gravelly sand. | SP, SM,<br>GP, GM | A-1, A-3,<br>A-2 | 0-7 | 35-100 | 30-100 | 5-70 | 0-30 | --- | NP |
| MoB*, MoC*-------<br>Moberg | 0-4 | Gravelly silt loam. | ML, CL,<br>SM, SC | A-4 | 0-3 | 65-90 | 50-85 | 45-85 | 35-75 | <26 | 2-8 |
| | 4-12 | Gravelly silt loam, gravelly loam. | SM, SC,<br>GM-GC, ML | A-2, A-4,<br>A-1 | 0-3 | 50-95 | 50-85 | 25-75 | 10-60 | <30 | NP-10 |
| | 12-20 | Very gravelly coarse sandy loam, very gravelly loamy sand, extremely gravelly loamy sand. | SM | A-1 | 0 | 70-100 | 40-100 | 20-30 | 12-20 | <30 | NP-6 |
| | 20-60 | Extremely gravelly loamy coarse sand, very gravelly loamy coarse sand. | SM, SW-SM,<br>SP-SM | A-1 | 0 | 70-100 | 40-100 | 20-35 | 5-20 | <30 | NP-4 |

See footnote at end of table.

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| MsB, MsC, MsD----<br>Mosinee | 0-7 | Sandy loam------- | SM, ML | A-2, A-4, A-1-b | 0-15 | 80-100 | 75-100 | 45-85 | 20-55 | <20 | NP-4 |
| | 7-19 | Gravelly sandy loam, very gravelly sandy loam, loam. | ML, SM, GM | A-2, A-4, A-1-b | 5-20 | 60-95 | 50-90 | 35-85 | 15-65 | <20 | NP-4 |
| | 19-42 | Gravelly sandy loam, very gravelly sandy loam, extremely gravelly sandy loam. | GM, SM, GP-GM, SP-SM | A-2, A-4, A-3, A-1 | 10-65 | 25-70 | 15-70 | 10-65 | 5-50 | <20 | NP-4 |
| | 42 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MtC----------<br>Mosinee | 0-7 | Sandy loam------- | SM, ML | A-2, A-4, A-1 | 25-50 | 80-100 | 75-100 | 45-85 | 20-55 | <20 | NP-4 |
| | 7-18 | Gravelly sandy loam, fine sandy loam, loam. | ML, SM, GM | A-2, A-4 | 5-20 | 60-95 | 50-90 | 35-85 | 25-65 | <20 | NP-4 |
| | 18-41 | Gravelly sandy loam, very gravelly sandy loam, extremely gravelly sandy loam. | GM, GP-GM, SM, SP-SM | A-1, A-2, A-3, A-4 | 10-65 | 25-70 | 15-70 | 10-65 | 5-50 | <20 | NP-4 |
| | 41 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MyB*----------<br>Mylrea | 0-12 | Silt loam-------- | CL-ML, ML, CL | A-4 | 0-3 | 90-100 | 85-100 | 75-100 | 60-90 | 20-30 | 3-10 |
| | 12-28 | Silt loam-------- | CL, CL-ML, ML | A-4 | 0-3 | 90-100 | 85-100 | 75-100 | 60-90 | 20-30 | 3-10 |
| | 28-38 | Fine sandy loam, gravelly fine sandy loam, gravelly loam. | CL, ML, SC, SM | A-2, A-4, A-1 | 0 | 75-100 | 70-100 | 35-95 | 15-75 | <32 | NP-10 |
| | 38-60 | Extremely gravelly loamy coarse sand, very gravelly coarse sandy loam. | SM | A-1, A-2 | 0 | 70-100 | 40-100 | 20-65 | 12-30 | <25 | NP-4 |
| MzB*----------<br>Mylrea | 0-3 | Silt loam-------- | CL-ML, ML, CL | A-4 | 25-50 | 90-100 | 85-100 | 75-100 | 60-90 | 20-30 | 3-10 |
| | 3-27 | Silt loam-------- | CL, CL-ML, ML | A-4 | 0-25 | 90-100 | 85-100 | 75-100 | 60-90 | 20-30 | 3-10 |
| | 27-39 | Loam, gravelly sandy loam, gravelly loam. | CL, ML, SC, SM | A-2, A-4, A-1 | 0 | 75-100 | 70-100 | 35-95 | 15-75 | <32 | NP-10 |
| | 39-60 | Extremely gravelly loamy coarse sand, very gravelly coarse sandy loam. | SM | A-1, A-2 | 0 | 70-100 | 40-100 | 20-65 | 12-30 | <25 | NP-4 |

See footnote at end of table.

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Ne<br>Newson | 0-3 | Mucky loamy sand | SM | A-2, A-1-b | 0 | 80-100 | 75-100 | 40-85 | 12-35 | --- | NP |
| | 3-23 | Loamy sand, sand | SM, SP-SM, SP | A-2, A-3, A-1-b | 0 | 80-100 | 75-100 | 45-75 | 3-30 | --- | NP |
| | 23-60 | Sand | SM, SP-SM, SP | A-2, A-3, A-1-b | 0 | 80-100 | 75-100 | 45-75 | 3-30 | --- | NP |
| Oe<br>Oesterle | 0-7 | Loam | CL-ML, SM-SC, CL, SC | A-4 | 0-7 | 80-100 | 75-100 | 65-95 | 45-85 | 20-26 | 4-8 |
| | 7-27 | Sandy loam, loam | CL-ML, CL, SM-SC, SC | A-2, A-4, A-1 | 0-7 | 75-100 | 70-100 | 40-95 | 20-75 | 20-30 | 4-10 |
| | 27-30 | Sandy loam, loamy sand, gravelly loamy sand. | SM, SP-SM, SM-SC, GM | A-2, A-1 | 0-7 | 55-95 | 55-95 | 25-75 | 10-35 | <23 | NP-6 |
| | 30-60 | Gravelly sand, sand, gravelly loamy sand. | SW, SP, GW, GP | A-1, A-3, A-2 | 0-7 | 35-95 | 35-95 | 15-70 | 0-30 | --- | NP |
| Pg, Ph.<br>Pits | | | | | | | | | | | |
| Po<br>Plover | 0-7 | Sandy loam | ML, SM | A-2, A-4 | 0 | 100 | 100 | 60-95 | 30-55 | <20 | NP-4 |
| | 7-28 | Fine sandy loam, sandy loam, loam. | SM, ML, SM-SC, CL-ML | A-4 | 0 | 100 | 100 | 70-100 | 40-75 | <20 | NP-5 |
| | 28-42 | Fine sandy loam, sandy loam, loam. | SM, ML, CL-ML, SM-SC | A-4 | 0 | 100 | 100 | 70-95 | 40-70 | <25 | NP-7 |
| | 42-60 | Stratified silt loam to sand. | SM, ML, CL-ML, SM-SC | A-4 | 0 | 100 | 100 | 65-100 | 40-70 | <25 | NP-7 |
| RbC, RbE<br>Ribhill | 0-4 | Cobbly silt loam | CL, CL-ML | A-4 | 25-50 | 80-95 | 75-95 | 70-95 | 50-95 | 23-28 | 6-9 |
| | 4-17 | Cobbly silt loam, silt loam. | CL, CL-ML, SC, SM-SC | A-4 | 5-50 | 80-95 | 75-95 | 65-95 | 45-85 | 23-28 | 6-9 |
| | 17-35 | Cobbly silt loam, very cobbly silt loam, gravelly silt loam. | SC, SM-SC, CL, CL-ML | A-4 | 30-60 | 65-75 | 60-75 | 50-75 | 35-70 | 23-28 | 6-9 |
| | 35 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RcB<br>Rietbrock | 0-8 | Silt loam | ML, CL, CL-ML | A-4 | 0-7 | 85-100 | 85-100 | 80-100 | 60-100 | 20-32 | 3-10 |
| | 8-15 | Silt loam, loam, fine sandy loam. | SM-SC, CL-ML | A-4 | 0-7 | 85-100 | 85-100 | 60-100 | 35-100 | 20-25 | 4-7 |
| | 15-29 | Loam, gravelly loam, gravelly sandy clay loam. | CL, GC, SC | A-2, A-6, A-7 | 7-25 | 50-85 | 50-80 | 45-80 | 20-65 | 30-45 | 11-25 |
| | 29-45 | Cobbly loam, very cobbly sandy clay loam, gravelly clay loam. | CL, GC, SC, GP-GC | A-2, A-4, A-6 | 7-55 | 30-75 | 30-75 | 20-75 | 10-60 | 25-40 | 7-20 |
| | 45 | Weathered bedrock, unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| ReB--- Rietbrock | 0-5 | Silt loam--- | ML, CL, CL-ML | A-4 | 25-50 | 85-100 | 85-100 | 80-100 | 60-100 | 20-32 | 3-10 |
| | 5-13 | Silt loam, loam, fine sandy loam. | SM-SC, CL-ML | A-4 | 0-10 | 85-100 | 85-100 | 60-100 | 35-100 | 20-25 | 4-7 |
| | 13-34 | Loam, gravelly clay loam, gravelly sandy clay loam. | CL, GC, SC | A-2, A-6, A-7 | 7-25 | 50-85 | 50-80 | 45-80 | 20-65 | 30-45 | 11-25 |
| | 34-42 | Cobbly loam, very cobbly sandy clay loam, gravelly loam. | CL, GC, SC, GP-GC | A-2, A-4, A-6 | 7-55 | 30-75 | 30-75 | 20-75 | 10-60 | 25-40 | 7-20 |
| | 42 | Weathered bedrock, unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| RhA--- Rockers | 0-6 | Loamy sand--- | SM, SP-SM | A-2, A-1 | 0 | 75-100 | 75-100 | 40-75 | 12-30 | --- | NP |
| | 6-27 | Loamy sand, sandy loam. | SM, SM-SC, SP-SM | A-2, A-4, A-1 | 0 | 75-100 | 75-100 | 40-75 | 12-40 | <23 | NP-6 |
| | 27-38 | Gravelly loam, loam, sandy loam. | GC, GM-GC, CL, SC | A-4, A-1, A-2 | 0 | 55-95 | 55-90 | 35-80 | 20-65 | <28 | NP-9 |
| | 38-60 | Gravelly loam, loam, gravelly sandy loam. | GC, SM-SC, CL, SC | A-4, A-1, A-2, A-6 | 0 | 55-95 | 55-90 | 35-85 | 20-70 | <32 | NP-13 |
| RoA, RoB--- Rosholt | 0-10 | Sandy loam--- | SM, SM-SC | A-2, A-1, A-4 | 0-8 | 75-100 | 75-100 | 45-70 | 20-40 | <25 | NP-4 |
| | 10-17 | Sandy loam, loam | SM, ML, SM-SC, CL-ML | A-2, A-4, A-1 | 0-8 | 75-100 | 75-100 | 35-95 | 12-70 | <25 | NP-6 |
| | 17-30 | Gravelly sandy loam, gravelly loamy coarse sand, loamy sand. | SM, GM, SP-SM, GP-GM | A-1, A-2, A-4 | 0-10 | 50-100 | 45-100 | 25-70 | 10-40 | <25 | NP-7 |
| | 30-60 | Stratified sand to gravel. | GP, SP, SP-SM, GP-GM | A-1, A-2, A-3 | 0-25 | 20-100 | 20-100 | 10-65 | 0-10 | --- | NP |
| RsA, RsB--- Rosholt | 0-7 | Silt loam--- | SM-SC, CL-ML, SM, ML | A-4 | 0-8 | 75-100 | 70-100 | 60-95 | 45-90 | <25 | 3-7 |
| | 7-18 | Loam, silt loam | SM, ML, SM-SC, CL-ML | A-4 | 0-8 | 75-100 | 70-100 | 60-95 | 45-90 | <25 | NP-6 |
| | 18-26 | Sandy loam, loam | SC, SM, CL, ML | A-2, A-4, A-1, A-6 | 0-8 | 75-100 | 70-100 | 35-95 | 12-75 | <30 | NP-13 |
| | 26-34 | Gravelly loamy sand, sandy loam, fine sandy loam. | SM, GM, SP-SM, GP-GM | A-1, A-2, A-4 | 0-10 | 50-100 | 45-100 | 25-80 | 10-50 | <25 | NP-7 |
| | 34-60 | Stratified sand to gravel. | GP, SP, SP-SM, GP-GM | A-1, A-2, A-3 | 0-25 | 20-100 | 20-100 | 10-65 | 0-10 | --- | NP |

See footnote at end of table.

Table 15.--Engineering Index Properties--Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| ScA--------------<br>Scott Lake | 0-8 | Sandy loam------- | SM, SM-SC,<br>ML, CL-ML | A-2, A-4,<br>A-1-b | 0-7 | 85-100 | 75-100 | 45-70 | 20-40 | <25 | 2-7 |
| | 8-29 | Loam, sandy loam,<br>fine sandy loam. | SC, CL,<br>SM, ML | A-2, A-4,<br>A-6 | 0-7 | 85-100 | 75-100 | 45-85 | 25-55 | 20-35 | 3-13 |
| | 29-33 | Sandy loam,<br>gravelly sandy<br>loam, loamy<br>sand. | SM, SW-SM,<br>SP-SM,<br>SM-SC | A-1, A-2,<br>A-3, A-4 | 0-35 | 70-100 | 50-95 | 20-80 | 7-50 | <25 | NP-6 |
| | 33-60 | Sand, gravelly<br>coarse sand,<br>very gravelly<br>coarse sand. | SP, SM,<br>GP, GM | A-1, A-2,<br>A-3 | 0-35 | 30-95 | 30-95 | 20-65 | 0-10 | --- | NP |
| SdA--------------<br>Scott Lake | 0-8 | Silt loam-------- | ML, CL-ML,<br>SM, SM-SC | A-4 | 0-7 | 85-100 | 75-100 | 65-100 | 45-95 | <25 | 3-7 |
| | 8-28 | Loam, silt loam | SC, CL,<br>SM, ML | A-2, A-4,<br>A-6 | 0-7 | 85-100 | 75-100 | 60-100 | 45-95 | 20-35 | 3-13 |
| | 28-31 | Sandy loam,<br>gravelly sandy<br>loam, loamy<br>sand. | SM, SW-SM,<br>SP-SM,<br>SM-SC | A-1, A-2,<br>A-3, A-4 | 0-35 | 70-100 | 50-95 | 20-80 | 7-50 | <25 | NP-6 |
| | 31-60 | Sand, gravelly<br>coarse sand,<br>very gravelly<br>coarse sand. | SP, SM,<br>GP, GM | A-1, A-2,<br>A-3 | 0-35 | 30-95 | 30-85 | 20-65 | 0-10 | --- | NP |
| Se---------------<br>Seelyeville | 0-4 | Sapric material | PT | A-8 | 0 | --- | --- | --- | --- | --- | --- |
| | 4-60 | Sapric material | PT | A-8 | 0 | --- | --- | --- | --- | --- | --- |
| ShA--------------<br>Sherry | 0-8 | Silt loam-------- | CL-ML, CL,<br>ML | A-4 | 0-7 | 90-100 | 90-100 | 80-100 | 60-95 | 20-30 | 3-10 |
| | 8-18 | Silt loam-------- | ML | A-4 | 0-7 | 90-100 | 90-100 | 80-100 | 70-95 | <20 | NP-4 |
| | 18-26 | Silt loam, silty<br>clay loam. | CL, ML,<br>CL-ML | A-4, A-6 | 0-7 | 90-100 | 90-100 | 80-100 | 60-95 | 20-40 | 5-20 |
| | 26-44 | Loam, clay loam,<br>gravelly sandy<br>loam. | SC, CL,<br>SM-SC,<br>CL-ML | A-2, A-4,<br>A-6, A-1 | 0-15 | 55-100 | 50-100 | 40-100 | 15-75 | 20-40 | 5-25 |
| | 44-60 | Loam, sandy clay<br>loam, gravelly<br>sandy loam. | SC, SM-SC,<br>CL, CL-ML | A-2, A-4,<br>A-6, A-1 | 0-15 | 55-100 | 50-100 | 40-95 | 15-75 | <35 | NP-15 |
| St---------------<br>Sturgeon | 0-8 | Silt loam-------- | ML, CL-ML | A-4 | 0 | 100 | 85-100 | 85-100 | 60-90 | <25 | 2-7 |
| | 8-31 | Silt loam, loam,<br>sandy loam. | ML, SM,<br>SC, CL | A-4 | 0 | 100 | 85-100 | 85-100 | 35-95 | <30 | NP-10 |
| | 31-60 | Sand, fine sand,<br>loamy sand. | SM, SP-SM | A-2, A-3,<br>A-1 | 0 | 95-100 | 85-100 | 35-80 | 5-35 | --- | NP |
| UoB, UoE.<br>Udorthents | | | | | | | | | | | |
| WtA, WtB---------<br>Withee | 0-8 | Silt loam-------- | CL, CL-ML | A-4 | 0-15 | 95-100 | 90-100 | 90-100 | 85-100 | 20-30 | 5-10 |
| | 8-25 | Silt loam-------- | CL, CL-ML | A-4, A-6 | 0-15 | 95-100 | 90-100 | 90-100 | 85-100 | 20-35 | 5-15 |
| | 25-45 | Loam, clay loam,<br>sandy clay loam. | CL, SC | A-6, A-7,<br>A-2 | 0-15 | 75-100 | 75-100 | 60-100 | 25-80 | 25-45 | 10-25 |
| | 45-60 | Loam, clay loam,<br>sandy clay loam. | CL, SC | A-6, A-7,<br>A-2, A-4 | 0-15 | 75-100 | 75-100 | 50-100 | 30-80 | 20-45 | 7-25 |

* Sieve sizes, liquid limit, plasticity index, and Unified and AASHTO classifications are based on crushed material. The coarse fragments are mostly the result of the disintegration of crystalline rocks and crush to sand size quite easily.

**Table 16.--Physical and Chemical Properties of the Soils**

**(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)**

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | K | T | | Pct |
| AbB | 0-7 | 5-12 | 1.35-1.65 | 0.6-2.0 | 0.20-0.24 | 5.1-7.3 | Low | 0.32 | 5 | 5 | 1-3 |
| Alban | 7-22 | 3-15 | 1.60-1.75 | 0.6-2.0 | 0.09-0.22 | 5.1-7.3 | Low | 0.17 | | | |
| | 22-38 | 8-15 | 1.55-1.65 | 0.6-2.0 | 0.12-0.20 | 5.1-7.3 | Low | 0.24 | | | |
| | 38-60 | 1-12 | 1.50-1.70 | 0.6-2.0 | 0.05-0.22 | 5.1-7.3 | Low | 0.24 | | | |
| Ad | 0-3 | 10-20 | 1.35-1.50 | 0.6-2.0 | 0.22-0.24 | 5.1-7.3 | Low | 0.37 | 4 | 5 | 4-16 |
| Altdorf | 3-12 | 20-30 | 1.45-1.55 | 0.2-2.0 | 0.18-0.22 | 3.6-5.5 | Moderate | 0.37 | | | |
| | 12-60 | 35-60 | 1.45-1.60 | 0.06-0.2 | 0.09-0.19 | 4.5-7.3 | High | 0.28 | | | |
| AmC | 0-8 | 6-14 | 1.25-1.80 | 0.6-2.0 | 0.15-0.24 | 4.5-7.3 | Low | 0.37 | 5 | 5 | 1-3 |
| Amery | 8-34 | 6-18 | 1.70-1.80 | 0.2-0.6 | 0.04-0.18 | 4.5-7.3 | Low | 0.24 | | | |
| | 34-60 | 4-18 | 1.80-2.00 | 0.0-0.2 | 0.04-0.15 | 5.1-6.5 | Low | 0.17 | | | |
| CbA | 0-6 | 12-16 | 1.10-1.35 | 0.2-2.0 | 0.10-0.20 | 4.5-7.3 | Low | 0.37 | 5 | 8 | 3-7 |
| Cable | 6-20 | 8-18 | 1.35-1.45 | 0.2-2.0 | 0.10-0.22 | 4.5-7.3 | Low | 0.37 | | | |
| | 20-30 | 8-16 | 1.40-1.90 | 0.2-2.0 | 0.03-0.18 | 4.5-7.3 | Low | 0.37 | | | |
| | 30-60 | 5-10 | 1.70-1.90 | 0.2-0.6 | 0.03-0.13 | 5.1-7.8 | Low | 0.28 | | | |
| Ch | 0-5 | --- | 0.28-0.45 | 0.2-6.0 | 0.45-0.55 | 4.5-7.8 | | ---- | 2 | 2 | 60-85 |
| Cathro | 5-28 | --- | 0.15-0.30 | 0.2-6.0 | 0.35-0.45 | 4.5-7.8 | | ---- | | | |
| | 28-60 | 10-30 | 1.50-1.70 | 0.2-2.0 | 0.11-0.22 | 5.6-8.4 | Low | ---- | | | |
| CkA, CkB, CkC, CkE | 0-8 | 4-12 | 1.35-1.70 | 0.6-2.0 | 0.10-0.15 | 5.1-6.5 | Low | 0.24 | 3 | 3 | 1-3 |
| Chetek | 8-13 | 4-15 | 1.40-1.70 | 0.6-2.0 | 0.09-0.19 | 5.1-6.5 | Low | 0.24 | | | |
| | 13-19 | 10-18 | 1.65-1.75 | 2.0-20 | 0.09-0.19 | 5.1-6.5 | Low | 0.24 | | | |
| | 19-60 | 1-6 | 1.50-1.60 | 6.0-20 | 0.02-0.04 | 5.1-6.5 | Low | 0.10 | | | |
| Da | 0-4 | 5-15 | 1.35-1.50 | 2.0-6.0 | 0.10-0.15 | 5.6-7.3 | Low | 0.20 | 5 | 3 | 1-3 |
| Dancy | 4-21 | 5-15 | 1.40-1.50 | 2.0-6.0 | 0.07-0.17 | 5.6-7.3 | Low | 0.17 | | | |
| | 21-41 | 18-30 | 1.50-1.60 | 0.6-2.0 | 0.08-0.19 | 5.6-7.3 | Moderate | 0.32 | | | |
| | 41-60 | 15-30 | 1.50-1.75 | 0.6-2.0 | 0.08-0.19 | 6.1-7.8 | Low | 0.24 | | | |
| DoA | 0-9 | 10-20 | 1.35-1.55 | 0.6-2.0 | 0.22-0.24 | 4.5-7.3 | Low | 0.43 | 3 | 5 | 3-7 |
| Dolph | 9-15 | 10-35 | 1.35-1.55 | 0.2-2.0 | 0.17-0.24 | 4.5-7.3 | Low | 0.37 | | | |
| | 15-37 | 35-70 | 1.45-1.60 | 0.06-0.2 | 0.09-0.20 | 3.6-5.5 | High | 0.28 | | | |
| | 37-60 | 25-50 | 1.40-1.65 | 0.2-0.6 | 0.14-0.20 | 5.1-6.5 | Moderate | 0.37 | | | |
| DuB | 0-8 | 5-10 | 1.35-1.55 | 0.6-6.0 | 0.12-0.22 | 5.1-6.5 | Low | 0.24 | 4 | 3 | 1-3 |
| Dunnville | 8-26 | 10-18 | 1.55-1.65 | 0.6-6.0 | 0.11-0.19 | 5.1-6.5 | Low | 0.28 | | | |
| | 26-36 | 5-10 | 1.60-1.70 | 0.6-6.0 | 0.09-0.17 | 5.1-6.5 | Low | 0.28 | | | |
| | 36-60 | 1-5 | 1.60-1.70 | 6.0-20 | 0.03-0.07 | 5.1-6.5 | Low | 0.15 | | | |
| FeC, FeD | 0-8 | 8-15 | 1.30-1.45 | 0.6-2.0 | 0.18-0.24 | 4.5-6.5 | Low | 0.37 | 3 | 5 | 2-4 |
| Fenwood | 8-18 | 6-14 | 1.40-1.70 | 0.6-2.0 | 0.15-0.21 | 4.5-6.5 | Low | 0.37 | | | |
| | 18-31 | 18-25 | 1.50-1.65 | 0.6-2.0 | 0.08-0.18 | 3.6-5.5 | Moderate | 0.37 | | | |
| | 31-43 | 18-25 | 1.55-1.70 | 0.6-2.0 | 0.06-0.16 | 3.6-5.5 | Low | 0.24 | | | |
| | 43 | --- | --- | --- | --- | --- | | ---- | | | |
| FfC, FfE | 0-9 | 8-15 | 1.30-1.45 | 0.6-2.0 | 0.10-0.20 | 4.5-6.5 | Low | 0.37 | 3 | 8 | 3-7 |
| Fenwood | 9-15 | 6-14 | 1.40-1.70 | 0.6-2.0 | 0.08-0.21 | 4.5-6.5 | Low | 0.37 | | | |
| | 15-27 | 18-25 | 1.50-1.65 | 0.6-2.0 | 0.07-0.18 | 3.6-5.5 | Moderate | 0.37 | | | |
| | 27-45 | 18-25 | 1.55-1.70 | 0.6-2.0 | 0.06-0.16 | 3.6-5.5 | Low | 0.24 | | | |
| | 45 | --- | --- | --- | --- | --- | | ---- | | | |

Table 16.--Physical and Chemical Properties of the Soils--Continued

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | K | T | | |
| | In | Pct | g/cc | In/hr | In/in | pH | | | | | Pct |
| FgB: | | | | | | | | | | | |
| Fenwood--------- | 0-8 | 8-15 | 1.30-1.45 | 0.6-2.0 | 0.18-0.24 | 4.5-6.5 | Low---------- | 0.37 | 3 | 5 | 2-4 |
| | 8-18 | 6-14 | 1.40-1.70 | 0.6-2.0 | 0.15-0.21 | 4.5-6.5 | Low---------- | 0.37 | | | |
| | 18-31 | 18-25 | 1.50-1.65 | 0.6-2.0 | 0.08-0.18 | 3.6-5.5 | Moderate----- | 0.37 | | | |
| | 31-43 | 18-25 | 1.55-1.70 | 0.6-2.0 | 0.06-0.16 | 3.6-5.5 | Low---------- | 0.24 | | | |
| | 43 | --- | --- | --- | --- | --- | ---------- | ---- | | | |
| Rozellville----- | 0-9 | 7-20 | 1.35-1.55 | 0.6-2.0 | 0.16-0.24 | 4.5-6.0 | Low---------- | 0.37 | 4 | 5 | 2-3 |
| | 9-14 | 6-24 | 1.40-1.70 | 0.6-2.0 | 0.13-0.22 | 4.5-6.0 | Low---------- | 0.37 | | | |
| | 14-35 | 18-30 | 1.40-1.70 | 0.6-2.0 | 0.10-0.19 | 4.5-6.0 | Low---------- | 0.37 | | | |
| | 35-60 | 10-27 | 1.35-1.75 | 0.6-2.0 | 0.02-0.19 | 5.1-6.0 | Low---------- | 0.24 | | | |
| Fh--------------- | 0-6 | 10-23 | 1.35-1.45 | 0.6-2.0 | 0.17-0.24 | 5.6-8.4 | Low---------- | 0.32 | 4 | 8 | 4-12 |
| Fordum | 6-30 | 8-18 | 1.40-1.50 | 0.6-6.0 | 0.10-0.22 | 5.6-8.4 | Low---------- | 0.43 | | | |
| | 30-60 | 2-5 | 1.55-1.70 | 6.0-20 | 0.04-0.10 | 5.6-8.4 | Low---------- | 0.15 | | | |
| FnB, FnC--------- | 0-9 | 5-18 | 1.25-1.55 | 0.6-2.0 | 0.20-0.24 | 4.5-7.3 | Low---------- | 0.37 | 5 | 5 | 1-3 |
| Freeon | 9-16 | 5-18 | 1.30-1.60 | 0.6-2.0 | 0.18-0.22 | 4.5-7.3 | Low---------- | 0.37 | | | |
| | 16-21 | 5-18 | 1.35-1.65 | 0.6-2.0 | 0.18-0.22 | 4.5-6.5 | Low---------- | 0.37 | | | |
| | 21-35 | 3-27 | 1.70-1.80 | 0.06-0.6 | 0.08-0.18 | 4.5-6.5 | Low---------- | 0.37 | | | |
| | 35-60 | 3-27 | 1.80-1.95 | <0.06 | 0. | 5.1-7.8 | Low---------- | 0.28 | | | |
| GcB--------------- | 0-9 | 0-10 | 1.30-1.55 | 6.0-20 | 0.06-0.12 | 4.5-7.3 | Low---------- | 0.10 | 5 | 2 | .5-2 |
| Graycalm | 9-26 | 0-15 | 1.25-1.60 | 6.0-20 | 0.05-0.10 | 4.5-7.8 | Low---------- | 0.15 | | | |
| | 26-52 | 0-10 | 1.50-1.65 | 6.0-20 | 0.04-0.09 | 4.5-7.3 | Low---------- | 0.15 | | | |
| | 52-60 | 0-10 | 1.50-1.65 | 6.0-20 | 0.04-0.06 | 5.6-8.4 | Low---------- | 0.15 | | | |
| Gm--------------- | 0-9 | 0-10 | 1.30-1.55 | 6.0-20 | 0.06-0.12 | 4.5-7.3 | Low---------- | 0.10 | 5 | 2 | .5-2 |
| Graycalm | 9-25 | 0-15 | 1.25-1.60 | 6.0-20 | 0.05-0.10 | 4.5-7.8 | Low---------- | 0.15 | | | |
| | 25-49 | 0-10 | 1.50-1.65 | 6.0-20 | 0.04-0.09 | 4.5-7.3 | Low---------- | 0.15 | | | |
| | 49-60 | 0-10 | 1.50-1.65 | 6.0-20 | 0.04-0.06 | 5.6-8.4 | Low---------- | 0.15 | | | |
| Gr--------------- | 0-4 | --- | 0.30-0.40 | 6.0-20 | 0.55-0.65 | 3.6-4.4 | ---------- | ---- | 3 | 5 | 55-75 |
| Greenwood | 4-60 | --- | 0.10-0.25 | 0.6-6.0 | 0.45-0.55 | 3.6-4.4 | ---------- | ---- | | | |
| GuB--------------- | 0-9 | 2-10 | 1.35-1.65 | 6.0-20 | 0.09-0.12 | 4.5-7.3 | Low---------- | 0.10 | 5 | 2 | .5-1 |
| Guenther | 9-31 | 1-10 | 1.60-1.70 | 6.0-20 | 0.05-0.11 | 4.5-6.5 | Low---------- | 0.17 | | | |
| | 31-37 | 18-30 | 1.60-1.70 | 0.6-2.0 | 0.09-0.19 | 4.5-6.5 | Moderate----- | 0.24 | | | |
| | 37-60 | 8-30 | 1.60-1.70 | 0.6-2.0 | 0.06-0.19 | 5.1-6.5 | Moderate----- | 0.32 | | | |
| HtB--------------- | 0-8 | 12-16 | 1.35-1.55 | 0.6-2.0 | 0.18-0.24 | 4.5-6.5 | Low---------- | 0.37 | 5 | 5 | 2-4 |
| Hatley | 8-13 | 3-12 | 1.40-1.70 | 0.6-2.0 | 0.07-0.22 | 4.5-6.5 | Low---------- | 0.24 | | | |
| | 13-30 | 5-18 | 1.55-1.65 | 0.6-2.0 | 0.12-0.22 | 4.5-6.5 | Low---------- | 0.24 | | | |
| | 30-60 | 4-10 | 1.55-1.70 | 0.6-6.0 | 0.06-0.12 | 4.5-7.8 | Low---------- | 0.24 | | | |
| HyB--------------- | 0-5 | 12-16 | 1.35-1.55 | 0.6-2.0 | 0.11-0.20 | 4.5-6.5 | Low---------- | 0.37 | 5 | 8 | 3-7 |
| Hatley | 5-14 | 3-12 | 1.40-1.70 | 0.6-2.0 | 0.07-0.22 | 4.5-6.5 | Low---------- | 0.24 | | | |
| | 14-32 | 5-18 | 1.55-1.65 | 0.6-2.0 | 0.07-0.22 | 4.5-6.5 | Low---------- | 0.24 | | | |
| | 32-60 | 4-10 | 1.55-1.70 | 0.6-6.0 | 0.05-0.12 | 4.5-7.8 | Low---------- | 0.24 | | | |
| KaB, KaC, KaD2--- | 0-8 | 5-12 | 1.20-1.60 | 0.6-2.0 | 0.09-0.18 | 4.5-7.3 | Low---------- | 0.24 | 5 | 3 | 1-3 |
| Kennan | 8-16 | 3-12 | 1.40-1.70 | 0.6-2.0 | 0.07-0.22 | 4.5-7.3 | Low---------- | 0.24 | | | |
| | 16-40 | 5-18 | 1.55-1.70 | 0.6-2.0 | 0.08-0.22 | 4.5-7.3 | Low---------- | 0.24 | | | |
| | 40-48 | 5-18 | 1.55-1.70 | 0.6-2.0 | 0.04-0.18 | 4.5-7.3 | Low---------- | 0.24 | | | |
| | 48-60 | 3-10 | 1.55-1.70 | 0.6-6.0 | 0.04-0.13 | 5.1-7.3 | Low---------- | 0.17 | | | |
| KeB, KeC, KeE---- | 0-3 | 5-12 | 1.20-1.60 | 0.6-2.0 | 0.06-0.15 | 4.5-7.3 | Low---------- | 0.24 | 5 | 8 | 2-5 |
| Kennan | 3-21 | 3-12 | 1.40-1.70 | 0.6-2.0 | 0.07-0.22 | 4.5-7.3 | Low---------- | 0.24 | | | |
| | 21-44 | 5-18 | 1.55-1.70 | 0.6-2.0 | 0.08-0.22 | 4.5-7.3 | Low---------- | 0.24 | | | |
| | 44-56 | 5-18 | 1.55-1.70 | 0.6-2.0 | 0.04-0.18 | 4.5-7.3 | Low---------- | 0.24 | | | |
| | 56-60 | 3-10 | 1.55-1.70 | 0.6-6.0 | 0.03-0.12 | 5.1-7.3 | Low---------- | 0.17 | | | |

Table 16.--Physical and Chemical Properties of the Soils--Continued

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | K | T | | Pct |
| LDF. | | | | | | | | | | | |
| Landfill | | | | | | | | | | | |
| LoB, LoC--- | 0-9 | 10-16 | 1.35-1.55 | 0.6-2.0 | 0.20-0.24 | 4.5-7.3 | Low--- | 0.37 | 5 | 5 | 1-3 |
| Loyal | 9-20 | 10-25 | 1.55-1.65 | 0.6-2.0 | 0.18-0.22 | 4.5-6.0 | Low--- | 0.43 | | | |
| | 20-49 | 15-25 | 1.70-1.90 | 0.06-0.2 | 0.06-0.16 | 4.5-6.0 | Low--- | 0.32 | | | |
| | 49-60 | 15-22 | 1.80-1.95 | <0.06 | 0. | 4.5-6.0 | Low--- | 0.28 | | | |
| MaB--- | 0-10 | 5-18 | 1.35-1.55 | 0.6-2.0 | 0.18-0.24 | 4.5-6.5 | Low--- | 0.37 | 5 | 5 | 1-3 |
| Magnor | 10-16 | 5-18 | 1.60-1.70 | 0.6-2.0 | 0.17-0.22 | 4.5-6.5 | Low--- | 0.37 | | | |
| | 16-50 | 3-12 | 1.40-1.70 | 0.06-0.6 | 0.08-0.18 | 4.5-6.0 | Low--- | 0.37 | | | |
| | 50-60 | 3-12 | 1.80-1.95 | <0.06 | 0. | 4.5-6.5 | Low--- | 0.24 | | | |
| MbB, MbC, MbE--- | 0-8 | 2-15 | 1.40-1.60 | 6.0-20 | 0.10-0.12 | 5.1-6.5 | Low--- | 0.10 | 5 | 2 | <1 |
| Mahtomedi | 8-24 | 2-15 | 1.45-1.70 | 6.0-20 | 0.05-0.10 | 5.1-6.5 | Low--- | 0.15 | | | |
| | 24-60 | 0-10 | 1.45-1.75 | 6.0-20 | 0.04-0.09 | 5.1-7.8 | Low--- | 0.10 | | | |
| McA--- | 0-7 | 2-15 | 1.40-1.60 | 6.0-20 | 0.07-0.11 | 5.1-6.5 | Low--- | 0.10 | 5 | 2 | <1 |
| Mahtomedi | 7-19 | 2-15 | 1.45-1.75 | 6.0-20 | 0.06-0.10 | 5.1-6.5 | Low--- | 0.17 | | | |
| | 19-37 | 0-10 | 1.45-1.75 | 6.0-20 | 0.04-0.10 | 5.1-7.8 | Low--- | 0.10 | | | |
| | 37-60 | 0-10 | 1.45-1.75 | 6.0-20 | 0.03-0.06 | 5.1-7.8 | Low--- | 0.10 | | | |
| MdB, MdC--- | 0-7 | 6-20 | 1.30-1.55 | 0.6-2.0 | 0.17-0.24 | 4.5-7.3 | Low--- | 0.37 | 4 | 5 | 2-4 |
| Marathon | 7-18 | 4-12 | 1.45-1.55 | 0.6-2.0 | 0.16-0.22 | 4.5-6.5 | Low--- | 0.37 | | | |
| | 18-29 | 10-18 | 1.50-1.60 | 0.6-2.0 | 0.13-0.22 | 4.5-6.5 | Low--- | 0.37 | | | |
| | 29-38 | 7-15 | 1.45-1.55 | 0.6-6.0 | 0.02-0.15 | 4.5-6.5 | Low--- | 0.17 | | | |
| | 38-57 | 2-8 | 1.45-1.55 | 2.0-6.0 | 0.02-0.10 | 4.5-6.5 | Low--- | 0.10 | | | |
| | 57-60 | 0-5 | 1.50-1.80 | 6.0-20 | 0.02-0.04 | 5.1-6.5 | Low--- | 0.10 | | | |
| MeC--- | 0-4 | 6-20 | 1.30-1.55 | 0.6-2.0 | 0.09-0.22 | 4.5-7.3 | Low--- | 0.37 | 4 | 8 | 3-7 |
| Marathon | 4-12 | 4-12 | 1.45-1.55 | 0.6-2.0 | 0.14-0.22 | 4.5-6.5 | Low--- | 0.37 | | | |
| | 12-18 | 10-18 | 1.50-1.60 | 0.6-2.0 | 0.14-0.22 | 4.5-6.5 | Low--- | 0.37 | | | |
| | 18-26 | 7-15 | 1.45-1.55 | 0.6-6.0 | 0.02-0.15 | 4.5-6.5 | Low--- | 0.17 | | | |
| | 26-41 | 2-8 | 1.45-1.55 | 2.0-6.0 | 0.02-0.10 | 4.5-6.5 | Low--- | 0.10 | | | |
| | 41-60 | 0-5 | 1.50-1.80 | 6.0-20 | 0.02-0.04 | 4.5-6.5 | Low--- | 0.10 | | | |
| MfA--- | 0-8 | 15-27 | 1.25-1.45 | 0.6-2.0 | 0.17-0.24 | 3.6-6.5 | Low--- | 0.32 | 5 | 6 | 3-16 |
| Marshfield | 8-16 | 8-23 | 1.40-1.60 | 0.6-2.0 | 0.17-0.24 | 3.6-6.5 | Low--- | 0.37 | | | |
| | 16-23 | 18-30 | 1.40-1.60 | 0.6-2.0 | 0.14-0.22 | 3.6-6.5 | Moderate--- | 0.37 | | | |
| | 23-34 | 16-30 | 1.55-1.75 | 0.2-2.0 | 0.12-0.20 | 4.5-7.3 | Moderate--- | 0.37 | | | |
| | 34-60 | 8-30 | 1.80-1.95 | 0.2-2.0 | 0.11-0.20 | 5.6-7.3 | Moderate--- | 0.28 | | | |
| MgA--- | 0-7 | 10-15 | 1.35-1.55 | 0.6-2.0 | 0.16-0.24 | 5.6-7.3 | Low--- | 0.32 | 5 | 5 | 1-3 |
| Meadland | 7-16 | 10-20 | 1.40-1.60 | 0.6-2.0 | 0.10-0.22 | 4.5-6.0 | Low--- | 0.24 | | | |
| | 16-41 | 18-30 | 1.40-1.70 | 0.2-2.0 | 0.10-0.19 | 4.5-6.0 | Moderate--- | 0.32 | | | |
| | 41-60 | 5-30 | 1.35-1.75 | 0.6-2.0 | 0.09-0.19 | 4.5-6.0 | Low--- | 0.32 | | | |
| MhA--- | 0-5 | 10-15 | 1.35-1.55 | 0.6-2.0 | 0.10-0.20 | 5.6-7.3 | Low--- | 0.32 | 5 | 8 | 3-7 |
| Meadland | 5-15 | 10-20 | 1.40-1.60 | 0.6-2.0 | 0.10-0.22 | 4.5-6.0 | Low--- | 0.24 | | | |
| | 15-25 | 18-30 | 1.40-1.70 | 0.2-2.0 | 0.10-0.19 | 4.5-6.0 | Moderate--- | 0.32 | | | |
| | 25-60 | 5-30 | 1.35-1.75 | 0.6-2.0 | 0.09-0.19 | 4.5-6.0 | Low--- | 0.32 | | | |
| Mm--- | 0-10 | 4-10 | 1.35-1.65 | 6.0-20 | 0.10-0.12 | 3.6-6.5 | Low--- | 0.10 | 5 | 2 | .5-3 |
| Meehan | 10-30 | 4-9 | 1.60-1.70 | 6.0-20 | 0.06-0.11 | 5.1-6.5 | Low--- | 0.17 | | | |
| | 30-60 | 1-4 | 1.60-1.70 | 6.0-20 | 0.02-0.07 | 5.1-6.5 | Low--- | 0.17 | | | |
| Mn--- | 0-5 | 5-10 | 1.20-1.65 | 0.6-2.0 | 0.12-0.15 | 4.5-7.8 | Low--- | 0.24 | 4 | 3 | 4-10 |
| Minocqua | 5-19 | 10-18 | 1.50-1.60 | 0.6-2.0 | 0.11-0.19 | 4.5-7.8 | Low--- | 0.37 | | | |
| | 19-23 | 3-10 | 1.65-1.75 | 2.0-20 | 0.06-0.13 | 4.5-7.8 | Low--- | 0.10 | | | |
| | 23-60 | 0-3 | 1.75-1.85 | 6.0-20 | 0.02-0.04 | 4.5-7.8 | Low--- | 0.10 | | | |

Table 16.--Physical and Chemical Properties of the Soils--Continued

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | K | T | | Pct |
| MoB, MoC | 0-4 | 8-16 | 1.35-1.55 | 2.0-6.0 | 0.14-0.22 | 4.5-6.5 | Low | 0.32 | 3 | 8 | 2-8 |
| Moberg | 4-12 | 12-18 | 1.55-1.65 | 2.0-6.0 | 0.07-0.15 | 4.5-6.5 | Low | 0.28 | | | |
| | 12-20 | 3-12 | 1.55-1.70 | 6.0-20 | 0.05-0.11 | 4.5-6.0 | Low | 0.17 | | | |
| | 20-60 | 0-5 | 1.50-1.80 | 6.0-20 | 0.02-0.04 | 4.5-6.0 | Low | 0.10 | | | |
| MsB, MsC, MsD | 0-7 | 4-8 | 1.35-1.70 | 0.6-6.0 | 0.09-0.18 | 4.5-7.3 | Low | 0.24 | 3 | 3 | 2-3 |
| Mosinee | 7-19 | 1-10 | 1.55-1.65 | 0.6-6.0 | 0.09-0.19 | 4.5-6.5 | Low | 0.17 | | | |
| | 19-42 | 1-10 | 1.55-1.70 | 0.6-6.0 | 0.02-0.15 | 4.5-6.5 | Low | 0.17 | | | |
| | 42 | --- | --- | --- | --- | --- | --- | ---- | | | |
| MtC | 0-7 | 4-8 | 1.35-1.70 | 0.6-6.0 | 0.06-0.15 | 5.6-7.3 | Low | 0.24 | 3 | 8 | 2-5 |
| Mosinee | 7-18 | 1-10 | 1.55-1.65 | 0.6-6.0 | 0.09-0.19 | 4.5-6.5 | Low | 0.17 | | | |
| | 18-41 | 1-10 | 1.55-1.70 | 0.6-6.0 | 0.02-0.15 | 4.5-6.5 | Low | 0.17 | | | |
| | 41 | --- | --- | --- | --- | --- | --- | ---- | | | |
| MyB | 0-12 | 10-14 | 1.35-1.55 | 0.6-2.0 | 0.20-0.24 | 4.5-6.5 | Low | 0.37 | 4 | 5 | 2-4 |
| Mylrea | 12-28 | 7-18 | 1.35-1.55 | 0.6-2.0 | 0.18-0.22 | 4.5-6.5 | Low | 0.37 | | | |
| | 28-38 | 4-18 | 1.55-1.70 | 0.6-2.0 | 0.03-0.18 | 4.5-6.5 | Low | 0.24 | | | |
| | 38-60 | 3-10 | 1.55-1.70 | 6.0-20 | 0.02-0.05 | 4.5-6.5 | Low | 0.10 | | | |
| MzB | 0-3 | 10-14 | 1.35-1.55 | 0.6-2.0 | 0.12-0.20 | 4.5-6.5 | Low | 0.37 | 4 | 8 | 3-7 |
| Mylrea | 3-27 | 7-18 | 1.35-1.55 | 0.6-2.0 | 0.15-0.22 | 4.5-6.5 | Low | 0.37 | | | |
| | 27-39 | 4-18 | 1.55-1.70 | 0.6-2.0 | 0.03-0.18 | 4.5-6.5 | Low | 0.24 | | | |
| | 39-60 | 3-10 | 1.55-1.70 | 6.0-20 | 0.02-0.05 | 4.5-6.5 | Low | 0.10 | | | |
| Ne | 0-3 | 4-12 | 1.35-1.65 | 6.0-20 | 0.08-0.13 | 3.6-6.0 | Low | 0.10 | 5 | 2 | 4-15 |
| Newson | 3-23 | 1-4 | 1.50-1.65 | 6.0-20 | 0.05-0.11 | 3.6-5.5 | Low | 0.17 | | | |
| | 23-60 | 1-4 | 1.50-1.65 | 6.0-20 | 0.04-0.10 | 4.5-6.5 | Low | 0.17 | | | |
| Oe | 0-7 | 10-15 | 1.35-1.55 | 0.6-2.0 | 0.16-0.24 | 4.5-6.5 | Low | 0.32 | 4 | 5 | 2-3 |
| Oesterle | 7-27 | 10-18 | 1.55-1.65 | 0.6-2.0 | 0.09-0.19 | 4.5-6.5 | Low | 0.24 | | | |
| | 27-30 | 6-12 | 1.55-1.70 | 0.6-6.0 | 0.05-0.13 | 4.5-6.5 | Low | 0.24 | | | |
| | 30-60 | 1-6 | 1.55-1.70 | 6.0-20 | 0.02-0.09 | 5.1-6.5 | Low | 0.10 | | | |
| Pg, Ph. | | | | | | | | | | | |
| Pits | | | | | | | | | | | |
| Po | 0-7 | 3-8 | 1.35-1.65 | 0.6-2.0 | 0.13-0.18 | 4.5-7.3 | Low | 0.24 | 5 | 3 | 2-3 |
| Plover | 7-28 | 5-18 | 1.40-1.70 | 0.6-2.0 | 0.15-0.19 | 4.5-7.3 | Low | 0.24 | | | |
| | 28-42 | 10-18 | 1.50-1.70 | 0.6-2.0 | 0.12-0.17 | 4.5-7.3 | Low | 0.24 | | | |
| | 42-60 | 1-12 | 1.50-1.70 | 0.6-2.0 | 0.11-0.22 | 5.6-7.3 | Low | 0.24 | | | |
| RbC, RbE | 0-4 | 6-18 | 1.30-1.55 | 0.6-2.0 | 0.15-0.17 | 4.5-6.0 | Low | 0.37 | 3 | 8 | 6-10 |
| Ribhill | 4-17 | 6-18 | 1.40-1.60 | 0.6-2.0 | 0.12-0.15 | 4.5-6.0 | Low | 0.28 | | | |
| | 17-35 | 6-18 | 1.55-1.65 | 0.6-2.0 | 0.12-0.15 | 4.5-6.0 | Low | 0.28 | | | |
| | 35 | --- | --- | --- | --- | --- | --- | ---- | | | |
| RcB | 0-8 | 9-14 | 1.35-1.45 | 0.6-2.0 | 0.18-0.24 | 4.5-7.3 | Low | 0.37 | 3 | 5 | 2-4 |
| Rietbrock | 8-15 | 8-12 | 1.50-1.70 | 0.6-2.0 | 0.13-0.22 | 4.5-7.3 | Low | 0.37 | | | |
| | 15-29 | 18-35 | 1.45-1.65 | 0.2-2.0 | 0.08-0.16 | 4.5-7.3 | Moderate | 0.28 | | | |
| | 29-45 | 15-32 | 1.50-1.75 | 0.2-2.0 | 0.03-0.15 | 5.1-7.8 | Low | 0.24 | | | |
| | 45 | --- | --- | --- | --- | --- | --- | ---- | | | |
| ReB | 0-5 | 9-14 | 1.35-1.45 | 0.6-2.0 | 0.13-0.17 | 4.5-7.3 | Low | 0.37 | 3 | 8 | 3-7 |
| Rietbrock | 5-13 | 8-12 | 1.50-1.70 | 0.6-2.0 | 0.12-0.22 | 4.5-7.3 | Low | 0.37 | | | |
| | 13-34 | 18-35 | 1.45-1.65 | 0.2-2.0 | 0.08-0.16 | 4.5-7.3 | Moderate | 0.28 | | | |
| | 34-42 | 15-32 | 1.50-1.75 | 0.2-2.0 | 0.03-0.15 | 5.1-7.8 | Low | 0.24 | | | |
| | 42 | --- | --- | --- | --- | --- | --- | ---- | | | |

Table 16.--Physical and Chemical Properties of the Soils--Continued

| Soil name and map symbol | Depth | Clay | Moist bulk density | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Pct | g/cc | In/hr | In/in | pH | | K | T | | Pct |
| RhA | 0-6 | 2-8 | 1.35-1.65 | 2.0-6.0 | 0.09-0.12 | 4.5-6.0 | Low | 0.15 | 5 | 2 | 1-2 |
| Rockers | 6-27 | 4-12 | 1.55-1.70 | 0.6-6.0 | 0.08-0.14 | 4.5-6.0 | Low | 0.17 | | | |
| | 27-38 | 10-18 | 1.55-1.70 | 0.6-2.0 | 0.08-0.17 | 4.5-6.0 | Low | 0.24 | | | |
| | 38-60 | 8-22 | 1.70-1.85 | 0.2-0.6 | 0.07-0.17 | 4.5-6.0 | Low | 0.24 | | | |
| RoA, RoB | 0-10 | 4-10 | 1.50-1.60 | 0.6-6.0 | 0.10-0.15 | 4.5-7.3 | Low | 0.24 | 4 | 3 | 1-3 |
| Rosholt | 10-17 | 3-12 | 1.70-1.80 | 0.6-6.0 | 0.10-0.18 | 4.5-7.3 | Low | 0.24 | | | |
| | 17-30 | 4-15 | 1.55-1.65 | 0.6-6.0 | 0.04-0.14 | 4.5-7.3 | Low | 0.10 | | | |
| | 30-60 | 0-5 | 1.50-1.80 | 6.0-20 | 0.02-0.04 | 5.1-6.5 | Low | 0.10 | | | |
| RsA, RsB | 0-7 | 7-13 | 1.50-1.60 | 0.6-2.0 | 0.20-0.24 | 4.5-7.3 | Low | 0.37 | 4 | 5 | 2-3 |
| Rosholt | 7-18 | 3-12 | 1.70-1.80 | 0.6-6.0 | 0.18-0.22 | 4.5-7.3 | Low | 0.32 | | | |
| | 18-26 | 6-15 | 1.65-1.75 | 0.6-6.0 | 0.12-0.19 | 4.5-7.3 | Low | 0.24 | | | |
| | 26-34 | 4-15 | 1.55-1.65 | 0.6-6.0 | 0.04-0.16 | 4.5-7.3 | Low | 0.10 | | | |
| | 34-60 | 0-5 | 1.50-1.80 | 6.0-20 | 0.02-0.04 | 5.1-6.5 | Low | 0.10 | | | |
| ScA | 0-8 | 6-15 | 1.35-1.50 | 0.6-2.0 | 0.10-0.15 | 4.5-6.5 | Low | 0.24 | 4 | 3 | 1-3 |
| Scott Lake | 8-29 | 8-18 | 1.55-1.70 | 0.6-2.0 | 0.09-0.17 | 4.5-6.5 | Low | 0.24 | | | |
| | 29-33 | 5-12 | 1.55-1.80 | 0.6-2.0 | 0.05-0.13 | 4.5-6.5 | Low | 0.24 | | | |
| | 33-60 | 0-5 | 1.55-1.80 | 6.0-20 | 0.01-0.04 | 4.5-7.3 | Low | 0.10 | | | |
| SdA | 0-8 | 10-15 | 1.35-1.50 | 0.6-2.0 | 0.20-0.24 | 4.5-6.5 | Low | 0.37 | 4 | 5 | 2-3 |
| Scott Lake | 8-28 | 8-18 | 1.55-1.70 | 0.6-2.0 | 0.17-0.22 | 4.5-6.5 | Low | 0.32 | | | |
| | 28-31 | 5-12 | 1.55-1.80 | 0.6-6.0 | 0.05-0.13 | 4.5-6.5 | Low | 0.24 | | | |
| | 31-60 | 0-5 | 1.55-1.80 | 6.0-20 | 0.01-0.04 | 4.5-7.3 | Low | 0.10 | | | |
| Se | 0-4 | --- | 0.10-0.25 | 0.2-6.0 | 0.35-0.45 | 4.5-8.4 | | ---- | 3 | 2 | >25 |
| Seelyeville | 4-60 | --- | 0.10-0.25 | 0.2-6.0 | 0.35-0.45 | 4.5-8.4 | | ---- | | | |
| ShA | 0-8 | 8-20 | 1.35-1.55 | 0.6-2.0 | 0.19-0.24 | 4.5-7.3 | Low | 0.37 | 5 | 5 | 4-16 |
| Sherry | 8-18 | 4-10 | 1.60-1.70 | 0.2-2.0 | 0.19-0.24 | 4.5-7.3 | Low | 0.37 | | | |
| | 18-26 | 12-30 | 1.55-1.65 | 0.2-2.0 | 0.15-0.22 | 4.5-7.3 | Low | 0.37 | | | |
| | 26-44 | 18-30 | 1.65-1.80 | 0.2-0.6 | 0.05-0.19 | 4.5-7.3 | Moderate | 0.37 | | | |
| | 44-60 | 8-25 | 1.65-1.80 | 0.2-0.6 | 0.04-0.19 | 5.1-7.8 | Low | 0.37 | | | |
| St | 0-8 | 2-15 | 1.40-1.65 | 0.6-2.0 | 0.22-0.24 | 4.5-6.5 | Low | 0.43 | 4 | 5 | 2-3 |
| Sturgeon | 8-31 | 5-18 | 1.50-1.70 | 0.6-2.0 | 0.10-0.22 | 4.5-6.5 | Low | 0.28 | | | |
| | 31-60 | 0-10 | 1.50-1.65 | 6.0-20 | 0.05-0.07 | 4.5-6.5 | Low | 0.15 | | | |
| UoB, UoE. | | | | | | | | | | | |
| Udorthents | | | | | | | | | | | |
| WtA, WtB | 0-8 | 12-18 | 1.20-1.45 | 0.6-2.0 | 0.19-0.24 | 4.5-7.3 | Low | 0.37 | 5 | 5 | 3-4 |
| Withee | 8-25 | 12-22 | 1.55-1.65 | 0.6-2.0 | 0.18-0.22 | 4.5-5.5 | Low | 0.37 | | | |
| | 25-45 | 18-25 | 1.75-1.85 | 0.06-0.2 | 0.05-0.10 | 4.5-5.5 | Moderate | 0.37 | | | |
| | 45-60 | 12-22 | 1.80-1.95 | <0.06 | 0. | 4.5-5.5 | Low | 0.37 | | | |

## Table 17.--Soil and Water Features

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Total subsidence | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | In | | | |
| AbB---- Alban | B | None | --- | --- | 2.5-3.5 | Perched | Sep-Jun | >60 | --- | --- | Moderate | Low | Moderate. |
| Ad---- Altdorf | D | None | --- | --- | +1-1.0 | Perched | Nov-May | >60 | --- | --- | High | High | High. |
| AmC---- Amery | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Moderate | Low | High. |
| CbA---- Cable | B/D | None | --- | --- | +1-1.0 | Apparent | Nov-May | >60 | --- | --- | High | High | High. |
| Ch---- Cathro | A/D | None | --- | --- | +1-1.0 | Apparent | Nov-Jun | >60 | --- | 19-22 | High | High | Low. |
| CkA, CkB, CkC, CkE---- Chetek | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Low | Low | High. |
| Da---- Dancy | B/D | None | --- | --- | +1-1.0 | Apparent | Nov-May | >60 | --- | --- | High | High | Moderate. |
| DoA---- Dolph | C | None | --- | --- | 1.0-3.0 | Perched | Nov-May | >60 | --- | --- | High | High | High. |
| DuB---- Dunnville | B | Rare | --- | --- | 3.0-6.0 | Apparent | Nov-May | >60 | --- | --- | Low | Moderate | Moderate. |
| FeC, FeD, FfC, FfE---- Fenwood | B | None | --- | --- | >6.0 | --- | --- | 40-60 | Hard | --- | Moderate | Moderate | High. |
| FgB: | | | | | | | | | | | | | |
| Fenwood---- | B | None | --- | --- | >6.0 | --- | --- | 40-60 | Hard | --- | Moderate | Moderate | High. |
| Rozellville---- | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Moderate | Moderate | High. |
| Fh---- Fordum | D | Frequent | Long | Mar-Jun | +1-1.0 | Apparent | Jan-Dec | >60 | --- | --- | High | High | High. |
| FnB, FnC---- Freeon | B | None | --- | --- | 2.0-3.5 | Perched | Nov-May | >60 | --- | --- | Moderate | Low | Moderate. |

Table 17.--Soil and Water Features--Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Total subsidence | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | In | | | |
| GcB---------- Graycalm | A | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Low------ | Low------ | Moderate. |
| Gm---------- Graycalm | A | None-------- | --- | --- | 2.5-4.5 | Apparent | Nov-May | >60 | --- | --- | Low------ | Low------ | Moderate. |
| Gr---------- Greenwood | A/D | None-------- | --- | --- | +1-1.0 | Apparent | Sep-Jun | >60 | --- | --- | High----- | High----- | High. |
| GuB---------- Guenther | B | None-------- | --- | --- | 2.5-6.0 | Perched | Nov-May | >60 | --- | --- | Low------ | Moderate | High. |
| HtB, HyB---- Hatley | C | None-------- | --- | --- | 1.0-3.0 | Apparent | Oct-Jun | >60 | --- | --- | High----- | Low------ | High. |
| KaB, KaC, KaD2, KeB, KeC, KeE-- Kennan | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Moderate | Low------ | High. |
| LDF. Landfill | | | | | | | | | | | | | |
| LoB, LoC---- Loyal | B | None-------- | --- | --- | 1.0-2.5 | Perched | Nov-Apr | >60 | --- | --- | Moderate | Moderate | High. |
| MaB---------- Magnor | C | None-------- | --- | --- | 1.0-3.0 | Perched | Sep-Jun | >60 | --- | --- | High----- | Low------ | Moderate. |
| MbB, MbC, MbE--- Mahtomedi | A | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Low------ | Low------ | High. |
| McA---------- Mahtomedi | A | None-------- | --- | --- | 2.5-6.0 | Apparent | Nov-Apr | >60 | --- | --- | Low------ | Low------ | High. |
| MdB, MdC, MeC--- Marathon | B | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Moderate | Low------ | Moderate. |
| MfA---------- Marshfield | B/D | None-------- | --- | --- | +1-1.0 | Perched | Oct-Jun | >60 | --- | --- | High----- | Moderate | High. |
| MgA, MhA---- Meadland | C | None-------- | --- | --- | 1.0-2.5 | Perched | Nov-Apr | >60 | --- | --- | High----- | Moderate | High. |
| Mm---------- Meehan | B | None-------- | --- | --- | 1.0-3.0 | Apparent | Oct-Jun | >60 | --- | --- | Moderate | Low------ | Moderate. |

Table 17.--Soil and Water Features--Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Total subsidence | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | In | | | |
| Mn<br>Minocqua | B/D | None | --- | --- | +1-1.0 | Apparent | Oct-Jun | >60 | --- | --- | High | High | High. |
| MoB, MoC<br>Moberg | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Low | Low | High. |
| MsB, MsC, MsD, MtC<br>Mosinee | B | None | --- | --- | >6.0 | --- | --- | 40-60 | Hard | --- | Moderate | Low | High. |
| MyB, MzB<br>Mylrea | C | None | --- | --- | 1.0-3.0 | Apparent | Nov-May | >60 | --- | --- | High | Low | High. |
| Ne<br>Newson | A/D | None | --- | --- | +1-1.0 | Apparent | Oct-Jun | >60 | --- | --- | Moderate | High | High. |
| Oe<br>Oesterle | C | None | --- | --- | 1.0-3.0 | Apparent | Oct-Jun | >60 | --- | --- | High | Low | Moderate. |
| Pg, Ph.<br>Pits | | | | | | | | | | | | | |
| Po<br>Plover | C | None | --- | --- | 1.0-3.0 | Apparent | Nov-May | >60 | --- | --- | High | Moderate | High. |
| RbC, RbE<br>Ribhill | B | None | --- | --- | >6.0 | --- | --- | 20-40 | Hard | --- | Moderate | Low | Moderate. |
| RcB, ReB<br>Rietbrock | C | None | --- | --- | 1.0-3.0 | Perched | Nov-May | 40-60 | Hard | --- | High | Moderate | Moderate. |
| RhA<br>Rockers | C | None | --- | --- | 1.0-3.0 | Apparent | Nov-Apr | >60 | --- | --- | High | Low | High. |
| RoA, RoB, RsA, RsB<br>Rosholt | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | --- | Moderate | Low | Moderate. |
| ScA, SdA<br>Scott Lake | B | None | --- | --- | 2.5-6.0 | Apparent | Nov-May | >60 | --- | --- | Moderate | Low | High. |
| Se<br>Seelyeville | A/D | None | --- | --- | +2-0.0 | Apparent | Oct-Jun | >60 | --- | 50-55 | High | High | Moderate. |
| ShA<br>Sherry | B/D | None | --- | --- | +1-1.0 | Perched | Nov-Jun | >60 | --- | --- | High | High | High. |

Table 17.--Soil and Water Features--Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Total subsidence | Potential frost action | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | | | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | In | | | |
| St---------- Sturgeon | B | Occasional | Brief----- | Mar-May | 0.5-1.5 | Apparent | Nov-May | >60 | --- | --- | High----- | Moderate | Moderate. |
| UoB, UoE. Udorthents | | | | | | | | | | | | | |
| WtA, WtB-------- Withee | C | None-------- | --- | --- | 0.5-2.5 | Perched | Oct-May | >60 | --- | --- | High----- | Low------ | High. |

Table 18.--Engineering Index Test Data

(Dashes indicate that data were not available. MAX means maximum dry density; OPT, optimum moisture; LL, liquid limit; PI, plasticity index; UN, Unified; and NP, nonplastic)

| Soil name and location | Parent material | Report number | Depth | Moisture density | | Percentage passing sieve*-- | | | | Percentage smaller than*-- | | | | LL | PI | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAX | OPT | No. 4 | No. 10 | No. 40 | No. 200 | 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | | | AASHTO | UN |
| | | | In | Lb/ cu ft | Pct | | | | | | | | | Pct | | | |
| Alban loam: NE1/4NW1/4 sec. 35, T. 29 N., R. 10 E. | Stratified loamy lacustrine deposits. | S79WI-073-2-1 | 22-38 | --- | --- | 100 | 100 | 88 | 48 | 43 | 31 | 16 | 11 | 23 | 7 | A-4(3) | SC |
| | | S79WI-073-2-2 | 38-60 | 112 | 13 | 100 | 100 | 74 | 6 | 5 | 4 | 2 | 2 | 15 | NP | A-3(0) | SM |
| Dolph silt loam: SW1/4NW1/4 sec. 28, T. 28 N., R. 9 E. | Silty deposits and clayey glacial till and residuum. | S78WI-073-4-1 | 15-37 | --- | --- | 100 | 100 | 96 | 85 | 83 | 76 | 63 | 58 | 86 | 57 | A-7-6 (20) | CH |
| | | S78WI-073-4-2 | 37-60 | --- | --- | 98 | 97 | 94 | 83 | 80 | 70 | 57 | 50 | 77 | 51 | A-7-6 (20) | CH |
| Fenwood silt loam: NW1/4NW1/4 sec. 27, T. 29 N., R. 7 E. | Silty deposits and loamy glacial till and residuum. | S61WI-37-2-1 | 18-38 | 123 | 12 | 95 | 92 | 86 | 61 | 55 | 36 | 25 | 21 | 27 | 12 | A-6(6) | CL |
| | | S61WI-37-2-2 | 38-50 | 136 | 9 | 93 | 92 | 84 | 31 | 27 | 16 | 10 | 8 | 17 | 4 | A-2-4 (0) | SM-SC |
| Freeon silt loam: NE1/4NE1/4 sec. 6, T. 29 N., R. 4 E. | Silty deposits and loamy glacial till. | S82WI-073-7-1 | 21-31 | --- | --- | 80 | 76 | 66 | 50 | 47 | 32 | 18 | 14 | 34 | 14 | A-6(5) | CL |
| | | S82WI-073-7-2 | 31-60 | --- | --- | 68 | 63 | 53 | 38 | 20 | 9 | 6 | 5 | 33 | 14 | A-6(2) | GC |
| Hatley silt loam, bouldery: SE1/4SW1/4 sec. 25, T. 18 N., R. 9 E. | Loamy deposits and loamy or sandy glacial till. | S82WI-073-1-1 | 20-32 | --- | --- | 92 | 89 | 77 | 48 | 45 | 30 | 15 | 10 | 27 | 9 | A-4(3) | SC |
| | | S82WI-073-1-2 | 32-44 | --- | --- | 85 | 76 | 57 | 21 | 20 | 15 | 8 | 6 | --- | NP | A-2-4 (0) | SM |
| | | S82WI-073-1-3 | 44-60 | --- | --- | 92 | 87 | 64 | 15 | 12 | 9 | 6 | 4 | --- | NP | A-2-4 (0) | SM |
| Kennan sandy loam, bouldery: NW1/4NE1/4 sec. 34, T. 28 N., R. 9 E. | Loamy deposits and loamy or sandy glacial till. | S75WI-073-1-1 | 31-42 | --- | --- | 93 | 87 | 70 | 30 | 26 | 18 | 8 | 6 | --- | NP | A-2-4 (0) | SM |
| | | S75WI-073-1-2 | 42-54 | --- | --- | 93 | 89 | 74 | 33 | 29 | 20 | 10 | 7 | --- | NP | A-2-4 (0) | SM |
| | | S75WI-073-1-3 | 65-84 | 132 | 8 | 86 | 79 | 57 | 18 | 15 | 11 | 6 | 4 | --- | NP | A-2-4 (0) | SM |

See footnote at end of table.

Table 18.--Engineering Index Test Data--Continued

| Soil name and location | Parent material | Report number | Depth | Moisture density | | Percentage passing sieve*-- | | | | Percentage smaller than*-- | | | | LL | PI | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAX | OPT | No. 4 | No. 10 | No. 40 | No. 200 | 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | | | AASHTO | UN |
| | | | In | Lb/ cu ft | Pct | | | | | | | | | Pct | | | |
| Magnor silt loam: Government lot 9, NE1/4NE1/4 sec. 6, T. 30 N., R. 9 E. | Silty deposits and loamy glacial till. | S81WI-073-16-1 | 10-24 | --- | --- | 97 | 95 | 91 | 78 | 73 | 47 | 19 | 13 | 24 | 3 | A-4(8) | ML |
| | | S81WI-073-16-2 | 30-51 | --- | --- | 100 | 98 | 87 | 41 | 35 | 25 | 15 | 11 | 20 | 6 | A-4(1) | SM-SC |
| | | S81WI-073-16-3 | 51-60 | --- | --- | 85 | 80 | 68 | 35 | 29 | 20 | 9 | 6 | --- | NP | A-2-4 (0) | SM |
| Marshfield silt loam: SW1/4NW1/4 sec. 1, T. 26 N., R. 3 E. | Silty deposits and loamy glacial till. | S76WI-73-1-1 | 16-34 | --- | --- | 100 | 100 | 97 | 91 | 88 | 60 | 32 | 25 | 40 | 21 | A-6(12) | CL |
| | | S76WI-73-1-2 | 34-60 | --- | --- | 91 | 86 | 74 | 50 | 47 | 26 | 13 | 9 | 25 | 8 | A-4(3) | CL |
| Meadland loam: SW1/4NE1/4 sec. 20, T. 27 N., R. 8 E. | Loamy deposits and loamy glacial till and residuum. | S81WI-073-18-1 | 16-24 | --- | --- | 91 | 85 | 76 | 37 | 33 | 21 | 7 | 5 | --- | NP | A-4(0) | SM |
| | | S81WI-073-18-2 | 30-38 | --- | --- | 100 | 100 | 93 | 63 | 56 | 38 | 23 | 18 | 35 | 14 | A-6(7) | CL |
| | | S81WI-073-18-3 | 38-57 | --- | --- | 100 | 100 | 95 | 72 | 60 | 28 | 15 | 11 | --- | NP | A-4(7) | ML |
| Moberg gravelly silt loam: NE1/4NE1/4 sec. 6, T. 27 N., R. 6 E. | Silty deposits and residuum. | S75WI-73-2-1 | 9-13 | --- | --- | 92 | 80 | 66 | 56 | 54 | 40 | 16 | 9 | 27 | 2 | A-4(4) | ML |
| | | S75WI-73-2-2 | 22-60 | --- | --- | 74 | 46 | 24 | 9 | 8 | 5 | 4 | 2 | 29 | NP | A-1-a (0) | SW-SM |
| Mosinee sandy loam: SW1/4NW1/4 sec. 3, T. 26 N., R. 7 E. | Loamy deposits and shattered bedrock. | S81WI-073-17-1 | 7-19 | --- | --- | 64 | 61 | 47 | 26 | 22 | 16 | 7 | 4 | --- | NP | A-2-4 (0) | SM |
| Mylrea silt loam: NW1/4NW1/4 sec. 3, T. 27 N., R. 6 E. | Silty deposits and loamy glacial till and residuum. | S75WI-73-4-1 | 28-33 | --- | --- | 98 | 96 | 88 | 56 | 50 | 25 | 9 | 6 | --- | NP | A-4(4) | ML |
| | | S75WI-73-4-2 | 38-60 | --- | --- | 86 | 80 | 64 | 29 | 25 | 16 | 8 | 6 | --- | NP | A-2-4 (0) | SM |
| Rietbrock silt loam: SW1/4NW1/4 sec. 26, T. 29 N., R. 5 E. | Silty deposits and gravelly and cobbly loamy glacial till and residuum. | S82WI-073-2-1 | 15-27 | --- | --- | 74 | 74 | 71 | 65 | 63 | 50 | 32 | 26 | 43 | 22 | A-7-6 (11) | CL |
| | | S82WI-073-2-2 | 27-42 | --- | --- | 72 | 71 | 66 | 58 | 55 | 44 | 28 | 22 | 38 | 18 | A-6(8) | CL |

See footnote at end of table.

Table 18.--Engineering Index Test Data--Continued

| Soil name and location | Parent material | Report number | Depth | Moisture density | | Percentage passing sieve*-- | | | | Percentage smaller than*-- | | | | LL | PI | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAX | OPT | No. 4 | No. 10 | No. 40 | No. 200 | 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | | | AASHTO | UN |
| | | | In | Lb/ cu ft | Pct | | | | | | | | | Pct | | | |
| Rockers loamy sand: | | | | | | | | | | | | | | | | | |
| NW1/4SW1/4 sec. 29, T. 28 N., R. 7 E. | Sandy deposits and loamy glacial till and residuum. | S76WI-073-2-1 | 21-32 | --- | --- | 92 | 81 | 71 | 30 | 25 | 14 | 5 | 4 | --- | NP | A-2-4 (0) | SM-SC |
| | | S76WI-073-2-2 | 32-60 | 127 | 8 | 95 | 89 | 77 | 32 | 27 | 14 | 4 | 2 | --- | NP | A-2-4 (0) | SM-SC |
| Rosholt sandy loam: | | | | | | | | | | | | | | | | | |
| NE1/4SW1/4 sec. 3, T. 26 N., R. 9 E. | Loamy deposits and sand and gravel. | S81WI-073-19-1 | 10-18 | --- | --- | 92 | 85 | 63 | 30 | 27 | 18 | 8 | 6 | --- | NP | A-2-4 (0) | SM |
| | | S81WI-073-19-2 | 18-27 | --- | --- | 82 | 70 | 50 | 26 | 23 | 16 | 9 | 7 | --- | NP | A-2-4 (0) | SM |
| Rosholt sandy loam: | | | | | | | | | | | | | | | | | |
| SE1/4NE1/4 sec. 11, T. 28 N., R. 10 E. | Loamy deposits and sand and gravel. | S78WI-073-3-1 | 16-30 | --- | --- | 95 | 94 | 81 | 31 | 27 | 19 | 7 | 4 | 15 | NP | A-2-4 (0) | SM |
| | | S78WI-073-3-2 | 30-39 | --- | --- | 71 | 62 | 38 | 16 | 15 | 10 | 4 | 3 | 18 | NP | A-1-6 (0) | SM |
| Rosholt silt loam: NE1/4SW1/4 sec. 14, T. 28 N., R. 10 E. | Silty and loamy deposits and sand and gravel. | S80WI-073-1-1 | 9-34 | --- | --- | 100 | 98 | 80 | 38 | 36 | 24 | 7 | 4 | --- | NP | A-4(1) | SM |
| Rozellville silt loam: | | | | | | | | | | | | | | | | | |
| SW1/4SE1/4 sec. 36, T. 30 N., R. 7 E. | Silty deposits and loamy glacial till and residuum. | S80WI-073-2-1 | 7-14 | --- | --- | 95 | 93 | 84 | 77 | 71 | 43 | 12 | 6 | --- | NP | A-4(8) | ML |
| | | S80WI-073-2-2 | 14-35 | --- | --- | 89 | 84 | 68 | 56 | 53 | 32 | 14 | 10 | --- | NP | A-4(4) | ML |
| | | S80WI-073-2-3 | 35-60 | --- | --- | 100 | 100 | 63 | 36 | 32 | 20 | 10 | 7 | --- | NP | A-4(0) | SM |
| Sherry silt loam: NW1/4NW1/4 sec. 10, T. 29 N., R. 8 E. | Silty deposits and loamy glacial till and residuum. | S79WI-073-3-1 | 18-38 | --- | --- | 91 | 87 | 78 | 68 | 64 | 48 | 20 | 13 | 27 | 6 | A-4(7) | CL-ML |
| | | S79WI-073-3-2 | 38-60 | --- | --- | 83 | 76 | 61 | 46 | 43 | 33 | 14 | 9 | --- | NP | A-4(2) | SM |
| Withee silt loam: NE1/4SW1/4 sec. 7, T. 27 N., R. 2 E. | Silty deposits and loamy glacial till. | S74WI-38-1-1 | 25-39 | --- | --- | 100 | 100 | 92 | 63 | 57 | 41 | 26 | 22 | 31 | 14 | A-6(7) | CL |
| | | S74WI-38-1-2 | 45-60 | 116 | 13 | 96 | 94 | 84 | 55 | 50 | 38 | 26 | 22 | 30 | 15 | A-6(6) | CL |

See footnote at end of table.

Table 18.--Engineering Index Test Data--Continued

| Soil name and location | Parent material | Report number | Depth | Moisture density | | Percentage passing sieve*-- | | | | Percentage smaller than*-- | | | | LL | PI | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MAX | OPT | No. 4 | No. 10 | No. 40 | No. 200 | 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | | | AASHTO | UN |
| | | | In | Lb/ cu ft | Pct | | | | | | | | | Pct | | | |
| Withee silt loam: SW1/4SE1/4 sec. 30, T. 27 N., R. 2 E. | Silty deposits and loamy glacial till. | S60WI-37-1 -1 | 18-30 | --- | --- | 100 | 100 | 94 | 78 | 76 | 60 | 36 | 30 | 41 | 24 | A-7-6 (14) | CL |
| | | S60WI-37-1 -2 | 37-50 | --- | --- | 100 | 100 | 91 | 68 | 66 | 54 | 38 | 32 | 40 | 25 | A-6(13) | CL |

* Mechanical analysis according to the AASHTO Designation T88-57 (1). Results from this procedure can differ somewhat from the results obtained by the soil survey procedure of the Natural Resources Conservation Service (NRCS). In the AASHTO procedure, the fine material is analyzed by hydrometer method and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the NRCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from the calculation of grain-size fractions. The mechanical analysis data given in this table are not suitable for use in naming textural classes of soils.

**Table 19.--Classification of the Soils**

**(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)**

| Soil name | Family or higher taxonomic class |
|---|---|
| Alban | Coarse-loamy, mixed Typic Glossoboralfs |
| Altdorf | Fine, mixed, frigid Aeric Glossaqualfs |
| Amery | Coarse-loamy, mixed Typic Glossoboralfs |
| Cable | Coarse-loamy, mixed, nonacid, frigid Typic Haplaquepts |
| Cathro | Loamy, mixed, euic Terric Borosaprists |
| Chetek | Coarse-loamy, mixed Eutric Glossoboralfs |
| Dancy | Fine-loamy, mixed, frigid Typic Glossaqualfs |
| Dolph | Fine, mixed Aquic Glossoboralfs |
| Dunnville | Coarse-loamy, mixed Udic Haploborolls |
| Fenwood | Fine-loamy, mixed Typic Glossoboralfs |
| Fordum | Coarse-loamy, mixed, nonacid, frigid Mollic Fluvaquents |
| Freeon | Coarse-loamy, mixed Typic Glossoboralfs |
| Graycalm | Mixed, frigid Alfic Udipsamments |
| Greenwood | Dysic Typic Borohemists |
| *Guenther | Sandy over loamy, mixed, frigid Alfic Haplorthods |
| Hatley | Coarse-loamy, mixed Aquic Glossoboralfs |
| Kennan | Coarse-loamy, mixed Typic Glossoboralfs |
| Loyal | Fine-loamy, mixed Oxyaquic Glossoboralfs |
| Magnor | Coarse-loamy, mixed Aquic Glossoboralfs |
| Mahtomedi | Mixed, frigid Typic Udipsamments |
| Marathon | Coarse-loamy, mixed Typic Glossoboralfs |
| Marshfield | Fine-loamy, mixed, frigid Typic Ochraqualfs |
| Meadland | Fine-loamy, mixed Aquic Glossoboralfs |
| Meehan | Mixed, frigid Aquic Udipsamments |
| *Minocqua | Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, frigid Typic Haplaquepts |
| Moberg | Sandy-skeletal, mixed, frigid Typic Dystrochrepts |
| Mosinee | Loamy-skeletal, mixed, frigid Typic Dystrochrepts |
| Mylrea | Coarse-loamy, mixed, frigid Aquic Dystrochrepts |
| *Newson | Mixed, frigid Humaqueptic Psammaquents |
| Oesterle | Coarse-loamy, mixed Aquic Glossoboralfs |
| Plover | Coarse-loamy, mixed Aquic Glossoboralfs |
| Ribhill | Loamy-skeletal, mixed Typic Glossoboralfs |
| Rietbrock | Fine-loamy, mixed Aquic Glossoboralfs |
| Rockers | Coarse-loamy, mixed, frigid Aqualfic Haplorthods |
| Rosholt | Coarse-loamy, mixed Typic Glossoboralfs |
| Rozellville | Fine-loamy, mixed Typic Glossoboralfs |
| Scott Lake | Coarse-loamy, mixed Typic Glossoboralfs |
| Seelyeville | Euic Typic Borosaprists |
| Sherry | Fine-loamy, mixed, frigid Udollic Ochraqualfs |
| *Sturgeon | Coarse-silty over sandy or sandy-skeletal, mixed, nonacid, frigid Aquic Udifluvents |
| Udorthents | Loamy, mixed, frigid Udorthents |
| Withee | Fine-loamy, mixed Aquic Glossoboralfs |

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